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Indonesian Marine Fish Parasite Biodiversity

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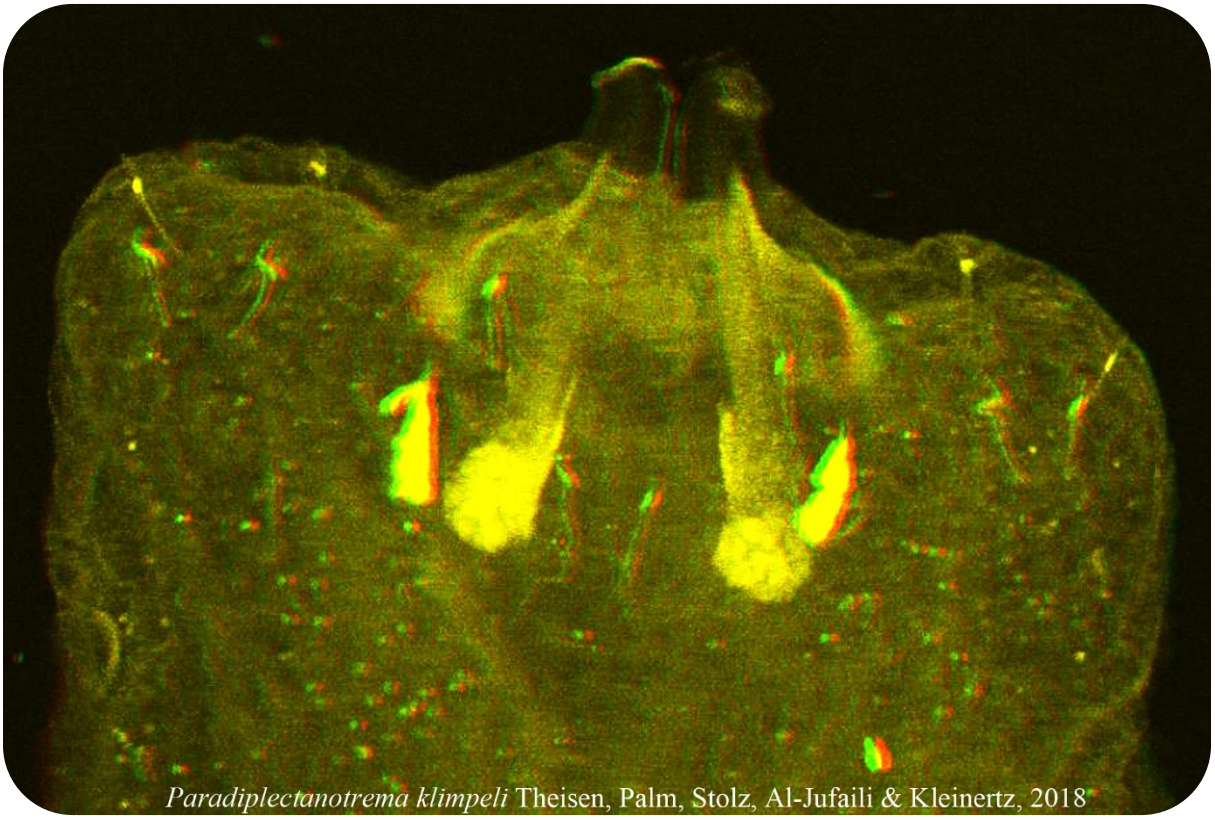

Paradiplectanotrema klimpeli Theisen, Palm, Stolz, Al-Jufaili & Kleinertz, 2018

My Parents

Content

I. List of Abbreviations

App./app	appendix
approx.	approximately
bc	buccal capsule
cae	caecum
cf.	confer/conferatur
d	dactylus
DNA	deoxyribonucleic acid
ed(s).	editor(s)
e.g.	exempli gratia
et al.	et alii
etc.	et cetera
FAO	Food and Agriculture Organisation of the United Nations
Fig(s).	figure(s)
ha	hectare
indet.	indeterminate
in prep.	in preparation
int	intestine
ITS	Internal Transcribed Spacer
km	kilometre
L	length
L.	Linnaeus
m	mean
mA	mean Abundance
mI	mean Intensity
mm	millimetre
n	number (e.g. of samples)
nov.	nova
nr	no record
oe	oesophagus
P	prevalence (in %)
p	propodus
sp. (spp.)	species (plural)
ssp.	subspecies
s.l.	sensu lato
s.s.	sensu stricto
Tab.	table
US(A/D)	United States (of America/dollars)
v.	vel
var.	varians
ve	ventricle
vs.	versus
W	width
&	and
°C	degree Celsius
µ	micro
%	percent
Ø	arithmetic mean
~	corresponds to
>	more than
=	similar to

II. List of Figures

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1. Summarising Introduction and Discussion

1.1 Abstract

This thesis covers the speciose parasite fauna of marine, free-living Indonesian teleost fishes. A literature collection of 201 published articles since 1840 was evaluated and refers to 2,327 host-parasite records of 514 parasite species (or lower taxa respectively) from 266 fish species. The history of fish parasitology from the region is described by and supplemented with newly cited and original published works. Adding 678 new parasite records from the present study (325 of these obtained during the First Educational Workshop on Marine Fish Parasites in Indonesia, Bali, in summer 2013) a total of 3,005 host-parasite records (147 without exact host fish identification) of 621 parasite species from 315 free-living marine Indonesian teleost species are presented. These host fishes belong to 94 families and 18 orders. Only 5.5% of the suggested Indonesian marine fish parasite fauna is now known to science, under the estimation of almost 3,400 marine bony fish species in Indonesian waters and an average of 3.3 up to 4 (specific) parasite species per sampled fish species.

A total of 1,531 free-living teleosts of 40 species were parasitologically and ecologically investigated from July 2010 to July 2012. Over 50,000 metazoan parasite individuals were isolated, resulting in 33 parasite individuals per fish specimen. An additional sampling (270 individuals of a further 96 fish species with an average of three investigated animals per species) took place in summer 2013 during the workshop. These studies recorded six Indonesian species or genotypes of ***Anisakis*** Dujardin, 1845, a genus of the Nematoda with zoonotic potential (zoonosis is defined as an animal - in this case fish - borne (parasitic) infection of humans). Of 136 teleost species, 22 were found to be infected with *Anisakis* larvae, establishing 16 new host records. So far, 53 Indonesian teleosts harbour *Anisakis* spp., 32 of them with known sequence data, increasing the worldwide teleosts with genetically identified *Anisakis* from 155 to 177. Besides 118 worms that were genetically identified, a revision of all available sequences of the ITS1-5.8S-ITS2 marker from Indonesian *Anisakis* in GenBank (n = 125) identified three *Anisakis* sp. HC- 2005 and 39 (16%) *A. typica* (Diesing, 1860) (sensu stricto). *Anisakis berlandi* Mattiucci et al., 2014 and *A. pegreffii* Campana-Rouget & Biocca, 1955 are reported for the first time from teleosts in the equatorial region and *A. physeteris* (Baylis, 1923) from the Pacific Ocean. The latter three species were exclusively found in the migratory scombrid *Auxis rochei* (Risso, 1810). Most common infection site was the body cavity, with 299 (of 848) worms in the mesenteries surrounding the liver, and 129 unattached. Musculature infection was very low, demonstrating only a minor risk of anisakiasis for human consumers in Indonesia. A total of 193 worms (~ 79%) had a distinct genotype distinguished from *A. typica* by four positions in the ITS-1 region. This genotype is reported since 2008 as `*A. typica*´, `sibling´, `*Anisakis* sp./type 1´, `sp. I´, `sp. 2´ or `sp. II´. To avoid further misleading identification, we applied the subspecific entity *Anisakis typica* var. *indonesiensis* until a description of the adults becomes available.

The oesophagus and anterior stomach of the croakers *Nibea soldado* (Lacépède, 1802) and *Otolithes ruber* (Bloch & Schneider, 1801) (n = 35 each) sampled from the South Java coast in May 2011 and *Johnius amblycephalus* (Bleeker, 1855) (n = 2) (all Sciaenidae) from Kedonganan fish market, South Bali coast, in November 2016, were infected with ***Pseudempleurosoma haywardi*** Theisen, Palm, Al-Jufaili & Kleinertz, 2017. Prevalences in the first two croakers were 63% and 46%, respectively, and the two *J. amblycephalus* harboured three and five individuals. All three croakers represent new hosts for this monogenean genus. The author provides infection rates, light microscopic observations, 3D confocal microscopic illustrations, and a morphometric comparison with all congeners. The new species differs in body size, the position and shape of the ovary and testes, and especially in the composition of the dorsal anchor complex and the male copulatory organ. The first DNA sequences for a member of this genus demonstrate close relatedness with endoparasitic freshwater monogeneans from African cichlid fishes. This suggests a freshwater origin for these marine endoparasitic monogeneans. A second new monogenean species, ***Paradiplectanotrema klimpeli*** Theisen, Palm, Stolz, Al-Jufaili & Kleinertz, 2018 was found in the Common grinner *Saurida tumbil* (Bloch, 1795) from the southern Balinese coast. This species is much larger, wider and characterised by the longest dorsal anchors relative to its congeners. Ventral anchors and ventral bars are the smallest in the genus, with a distinct ratio of 1:1. This is the first species with a gladiator breastplate shaped dorsal bar, with a length:width ratio of 1:1. Only the oesophagi of the hosts were infected (prevalence = 17%) at an intensity of 12 (1-21). This is the first record of the genus from the eastern Indian Ocean, and lizardfishes represent a new host family. We provide light microscopy (in situ in oesophageal folds), three-dimensional confocal illustrations and a morphometric comparison of all congeners, with remarks on *P. haywardi*. First 28S DNA sequences for *Paradiplectanotrema* Gerasev, Gayevskaya & Kovaleva, 1987 allocate the new species also close to endoparasitic freshwater monogeneans. Its ecology differs from *Pseudempleurosoma* Yamaguti, 1965 by utilising deep-water fishes instead of coastal, coral reef-associated hosts; however, both genera infect schooling, bottom-dwelling fishes.

Finally, the description of a new bucephalid digenean species, namely ***Bucephalus damriyasai*** Bray, Palm & Theisen, 2018 ex the Blacktip trevally *Caranx heberi* (Bennett, 1830) from Bali, Indonesia, is presented. It can be distinguished from other *Bucephalus* spp. from carangid fishes by its narrow elongate body shape and the relatively long distance between the rhynchus and the vitellarium, as well as other features distinguishing it from individual species. The distinctive features of *B. damriyasai* are compared with those of all other marine *Bucephalus* spp. in a table. The number of bucephalid trematodes known from Indonesian waters is now 13; two of them await further identification.

The new host-parasite checklist from Indonesian waters is evaluated according to the major parasite taxa and hosts. E.g. for fungi, Protista and Myxozoa, the family of the pufferfishes (Tetraodontidae) is recognised as remarkable hosts. Besides *Bucephalus* von Baer, 1827, the digenean genus *Qadriana* Bilqees, 1971 is described for the first time from Indonesia. In the Cestoda, two yet undescribed species are mentioned. In the Nematoda, besides the special focus on the zoonotic genus *Anisakis*, a summary

of the commercially important Philometridae (worms with the ability to castrate their fish hosts via gonad infections) is provided. First data on the nematode genus *Hysterothylacium* Ward & Magath, 1917 from Indonesia is also presented. An identification scheme for Indonesian nematodes is given. A first summary of regional marine Acanthocephala is introduced. New, yet undescribed Copepoda are presented, as well as a key to Isopoda families of Indonesia.

This new data set is discussed under consideration of the parasite biodiversity of tropical Hawaii and with a recently compiled host-parasite checklist for Indonesian aquacultured marine fishes, to estimate the species richness and risk potential of fish parasites from free-living fish for local aquaculture and the fisheries industries, as well as for the consumers. This supports a better understanding of the tropical marine biodiversity of fish parasites especially in the Indian Ocean, and their importance for the marine ecosystems, fisheries and the aquaculture industry, and also studies of the phylogeny of marine fish parasites broadly.

Keywords: Indonesia, marine Actinopterygii (~ ray-finned fishes, Teleostei), free-living vs. aquacultured fish parasites, fish host-parasite checklist, new species descriptions, biodiversity, Monogenea: `*Diplectanotrema*-group´, Digenea: *Bucephalus*, *Qadriana*, Nematoda: *Anisakis*, *Philometra*, Cestoda, Copepoda, Isopoda family key

1.2 Scope and Structure

This cumulative dissertation consists of three parts. The *first part* comprises **Chapter 1**. This chapter includes the summarising **introduction and discussion** and refers to the relevant background information. Characteristics of the studied region, the Indonesian archipelago, are presented, in particular by means of the description of the local species richness of marine teleosts and its importance for fisheries and mariculture. After a historical overview of the regional marine fish parasitology, current works on the topic are described. Each major important parasite group is treated separately. Therefore, all available publications on parasite and host records since 1840 are recorded herein. New insights into the parasite diversity for the Indo-Pacific region are provided. In the discussion section, all results are discussed in the overall context together with new parasite species descriptions and morphological and molecular works between 2010 and 2018. The identification of the known host-parasite records is updated, and special attention is given to the parasite biodiversity and parasite-host interactions also via new parasite, host and locality records, as well as new species descriptions. Finally, the Indonesian parasite richness of free-living marine teleosts is discussed with respect to a recent compilation of local maricultured fish parasites and that of another tropical locality, specifically Hawaii in the Central Pacific. This enables a better estimation of the species richness in historically and geographically different tropical ecosystems and differences between natural and anthropogenically influenced habitats, leading to the identification of parasites that are harmful for aquaculture facilities. The discussion ends with a summary, conclusion and an outlook.

The *middle section* consists of **Chapters 2 to 5**, which contain four publications relevant for this cumulative dissertation: **Chapter 2** provides a survey on Indonesian ***Anisakis*** Dujardin, 1845, with conclusions on the true identity and zoogeographical distribution of this circumglobal zoonotic nematode genus. Listing all known Indonesian *Anisakis* records and their host species allows conclusions to be drawn on the distribution patterns of these worms, contributing towards the provision of informative consumer advice. Data sampled and analysed newly after the publication in 2017 completes this research, with new host records for these zoonotic, human pathogenic worms. **Chapters 3 and 4** provide the descriptions of two new monogeneans, ***Pseudempleurosoma haywardi*** Theisen, Palm, Al-Jufaili & Kleinertz, 2017 and ***Paradiplectanotrema klimpeli*** Theisen, Palm, Stolz, Al-Jufaili & Kleinertz, 2018, both representing the first endoparasitic monogeneans from the Indian Ocean. First DNA sequences of these taxa secure their position within the Dactylogyridae, and indicate an African freshwater origin of these worms. **Chapter 5** provides the description of a new digenean trematode, ***Bucephalus damriyasai*** Bray, Palm & Theisen, 2018, from the Blacktip trevally of Balinese waters. This taxon is reviewed for Indonesian waters, pointing out their most important hosts, namely commercially highly important trevallies and groupers (Carangidae and Serranidae).

The *third part* contains the accompanying **Chapters 6 to 12**: **Chapters 6 and 7** are declarations, **Chapters 8 and 9** the curriculum vitae and acknowledgements, and **Chapter 10 to 12** the appendix, which provides the **annotated fish-parasite checklist and the literature references known for Indonesian marine waters** (except aquaculture and elasmobranchs) **since 1840.**

1.3 Overall Introduction

1.3.1 Fish Parasitology

Parasitism is one of the most successful modes of life (Poulin & Morand 2000). Kuris et al. (2008) demonstrated the importance of parasitic organisms, documenting that the parasite biomass can exceed that of the top predators in a coastal ecosystem. Fish parasitology, evidently accessible only to a limited `inner´ group of people, is important for zoology, fisheries, marine and ecosystem studies, because parasites inhabit all living organisms, including commercially important fish. They link all trophic levels through the natural food webs, e.g. in the world's oceans, due to their complex life cycles with various intermediate hosts, in all marine habitats including aquaculture facilities worldwide (see Palm & Bray 2014). They can damage the host, e.g. can castrate it, alter its phenotype (Palm et al. 2018) and lead to reduced fitness or even mortality. Fish processing (filleting, marketing/sale) can therefore become negatively impacted (see Palm & Bray 2014).

Palm & Bray (2014) stated that the number of metazoan fish parasites exceeds their host number by > three times. However, because fish and their parasite biodiversity in tropical regions are extremely high and research effort is often limited, only relatively few data on accurate species identifications and compositions from typical tropical localities exist.

The sampling methods for fish parasites, with standardised sampling protocols, and the isolation, fixation, preparation and curation of samples have been described by various authors, e.g. in Palm (2004) for the trypanorhynch Cestoda, in Palm & Bray (2014) for other phyla such as the Myxozoa, or in e.g. Justine et al. (2012) and Cribb & Bray (2010) for gut and gill parasites.

Parasite-host checklists provide an overview of the known biodiversity and simplify further fish parasitological investigations (see also below). Some parasites are strictly host specific, e.g. to their final host, while some taxa's life cycle stages can infect a wide range of different hosts, e.g. fish species. Together with their hosts' zoogeographical distribution, some are cosmopolitan while others are locally restricted, e.g. endemic Hawaiian species (see Palm & Bray 2014).

Palm & Bray (2014) discussed the marine fish parasite fauna of Hawaii, pointing out the challenges faced by scientists newly entering fish parasitology who need thorough literature studies and an extensive knowledge of the parasite taxonomy and morphology as well as of the biodiversity in marine environments. The authors stated that literature is often widely scattered or `grey´, e.g. published in non peer reviewed local publications. Parasite-host checklists, as provided within this thesis for marine free-living teleosts from Indonesia, a marine biodiversity hotspot, can be considered as an incentive to foster

future research, reflecting the current state of knowledge and pointing out poorly investigated fish and parasite taxa. A thorough checklist, providing all relevant literature, is a very helpful tool also just for regular parasite identification.

Because of this importance, checklists are already available for many regions and ecosystems, e.g. covering Canada, the USA and German coastal waters (Love & Moser 1983, Margolis & Arthur 1979, McDonald & Margolis 1995, Palm et al. 1999), the Barents Sea (Karasev 2003), and deep-sea fishes (Klimpel et al. 2001, 2009). A first short checklist for tropical waters (Thailand) was published by Sirikanchana (1982). Arthur & Lumanlan-Mayo (1997) and Arthur & Ahmed (2002) provided checklists from two tropical localities, the Philippines and Bangladesh. A total of 201 parasite species were recorded from the Philippines (1.2 parasite species per fish species), and 147 species from Bangladesh (1.7 parasite species per fish species). However, these lists cannot be considered even nearly complete. Australia was covered by Beumer et al. (1983). Bilqees (1995) published a list on marine fish parasites from Pakistan. Further checklists are available for Puerto Rican freshwater (Bunkley-Williams & Williams 1994) as well as from offshore and western Atlantic big game fish (Williams & Bunkley-Williams 1996), for North European freshwater fish (Pikalov 2017), fish parasites of the Czech and the Slovak Republic (Moravec 2001a) and Vietnamese fishes (Arthur & Quang Te 2006), and, most recently, for Hawaii (Palm & Bray 2014). Additionally, Kleinertz & Palm (in prep., available in Kleinertz 2017) summarised the history of fish parasitology in Indonesia within a parasite-host checklist for Indonesian mariculture. Many other more specific checklists focus on the respective fish or fish parasite families, e.g. parasites of snappers and breams in New Caledonia, philometrid nematodes and bucephalid Digenea of Indonesian fish, taeniacanthid copepods of India, or bomolochid copepods of Pacific clupeid fishes, acanthocephalans of Vietnam, monogeneans and copepods of scombrid fishes, *Anisakis* nematodes in Indonesia, isopods and trematodes of the Indian Ocean, Chinese Sea and Great Barrier Reef, on anthropogenically influenced Vietnamese bays etc. (Amin et al. 2014, Bray & Palm 2009, Cressey & Boyle 1973, 1980, Cribb et al. 1994, Devi & Shyamasundari 1980, Dewi & Palm 2017, Hadfield et al. 2013, Justine et al. 2012, Justo & Kohn 2015, Liu et al. 2010, Palm & Theisen et al. 2017, Sidabalok 2013, Truong 2018, Velasquez 1975).

1.3.2 Maritime Indonesia

Indonesia, one of the largest countries in the world, consists of > 17,500 islands, covering 5.8 million km^2 of the sea. The > 95,000 km long coastline is one of the largest worldwide (Burke et al. 2001). More than 130 million people live within 50 km of the coast (Kleinertz 2017). Indonesia is a biodiversity hotspot, terrestrial and especially marine, due to the geographical history and location, and as of July 2017, the total area of protected marine and coastal ecosystems has reached 19.1 million ha (CEA 2018, Froese et al. 1996, Huffard et al. 2012, Palm 2011, Tomascik et al. 1997).

By 1990, Indonesia was one of the largest fishing nations worldwide. Between 2015 and 2016, Indonesia was the top fisheries and aquaculture producer besides China, and local statistics suggest the

natural resources have huge potential for fisheries, with 2.9 million ha potential for brackish water aquaculture, and 12 million potential ha for mariculture (FAO 2018, Harris 2000, Pollunin 1983, Rahmantya et al. 2015). With an up to USD 4.1 billion value of wild capture/aquaculture exports in 2017, these sectors generate income and jobs but also provide primary food resources for the local population (CEA 2018, Dahuri 2000, Kleinertz 2017). Fish is mostly consumed fresh, as fish balls, dried and/or salted. Freshwater fishes are more speciose than marine forms due to the separation of freshwater bodies around the world. However, in maritime Indonesia, from a total of 4,740 fish species known from the country (including freshwater), almost 3,400 are marine bony fishes, with more than 2,000 of them being reef-associated and several hundred pelagic or occurring in deep waters, demonstrating their species richness in these environments (Froese & Pauly 2018) of the region.

1.3.3 Marine Fish Parasitology in Indonesia

In the checklist for Indonesian mariculture fish parasites (Kleinertz & Palm in prep., available in Kleinertz 2017), the authors provided a detailed introduction to marine fish parasitology in Indonesia. They intensively summarised the history of local fish parasitology, from the record of tumor-like growths in the bones of a butterflyfish in 1793 (that was 189 years later associated with the presence of fish parasitic fungi, see Bell & Banks (1793) and Möller & Anders (1986)). They mentioned the first marine fish parasitic isopod species description in 1840 (Milne Edwards 1840), and a second period from 1850-1905, a third period until 1960, a fourth period until 2000, and finally the most recent activities until 2015. The authors gave a brief summary of nearly all more recently published articles separately. This is not to be repeated here, but this work is advised for further reading.

Kleinertz (2017) summarised that the majority of fish parasitological investigations in Indonesia focused either on maricultured fish or on commercially important species, e.g. groupers (cf. also Kleinertz 2010, Kleinertz et al. 2014, Kleinertz & Palm 2015, Kuchta et al. 2009, Palm 2000, Palm et al. 2008, 2011, 2017, Rückert et al. 2008, 2009a, b, 2010 and Stolz 2017). Theisen (2009) investigated eight free-living fish species off the Java coast in his diploma thesis.

In 2006, more than ten years ago, > 400 parasite species were recorded locally, which is less than approx. 3.3% of the estimated species richness, taking the currently known fish species into account (cf. Froese & Pauly 2018, Jakob & Palm 2006). This demonstrates the need for future research effort to describe the real species biodiversity in Indonesian waters, as mentioned by Kleinertz (2017). According to Palm & Bray (2014), Kleinertz (2017) and Neubert (2018), accounting almost 3,400 marine Indonesian bony fish species (Froese & Pauly 2018) and 3.3 metazoan (host specific) parasite taxa per fish host on average, more than 11,220 marine metazoan fish parasitic species can be assumed in Indonesia. A total of 54 different trypanorhynch cestodes species were described mainly from the southern Java coast alone, mainly from sharks and rays (about 20% of the then known biodiversity in that group) (Palm 2004), demonstrating the importance of this region for the biodiversity of certain taxa.

As Kleinertz (2017) stated, local fish parasitology, worldwide and in Indonesia, follows a typical pattern: At first, zoonotic parasite species are investigated, followed by parasite surveys of commercially important hosts, e.g. fish. These activities started in Indonesia in 2008 already (Palm et al. 2008), and were carried out within the SPICE project (Science for the Protection of Indonesian Coastal Ecosystems, project duration 2001-2016). Now, gaps in the knowledge of the overall taxonomy and species diversity must be closed. Finally, studies on ecosystem structure, intraspecific interactions, and parasites as biological indicators do follow (Kleinertz 2017). The latter already started in mariculture facilities and utilised grouper parasites as biological indicators in Indonesia (e.g. Jakob 2005, Jakob & Palm 2006, Kleinertz 2010, Kleinertz et al. 2014, Kleinertz & Palm 2015, Neubert 2018, Neubert et al. 2016a, b, Rückert 2006, Rückert et al. 2008, 2009a, b, 2010).

For the present thesis, a detailed overview of fish parasites of wild Indonesian teleosts considered 40 free-living marine fish species with 1,531 individuals (mean of 38 specimens per species), sampled between 2010 and 2012. Focusing on the full range of metazoans, further 270 individuals from 96 species (mean three specimens per species) were investigated during the First Educational Workshop on Marine Fish Parasites in Indonesia, Bali, 2013 (compare Palm & Theisen et al. 2017). Additional samples of e.g. aquacultured groupers and Sand perch were investigated between 2010 and 2016.

The most commonly recorded fish parasite taxa, besides pathogens such as bacteria, virus, fungi, protistians and myxozoans, are worms sensu lato, e.g. flat-, round- and thorny-headed worms (with Trematoda/Digenea and Monogenea (flukes), Cestoda, Nematoda and Acanthocephala sensu stricto), leeches (Hirudinea), crustacean fish lice (Copepoda) and isopods. Species richness in these taxa differs, from the digeneans (approx. 14,000 species), monogeneans (11,000) and parasitic crustaceans (5,750) to cestodes (1,300) (Palm & Bray 2014).

1.3.3.1 Fungi, Protista and Myxozoa

According to the classification by Paladini et al. (2017), the class Microsporea, phylum Microsporidia, has previously been considered as Protista, but recent molecular evidence suggests they are basal fungi. Protista is a large paraphyletic group according to Dyková & Lom (2007), O'Donoghue (2005) and Paladini et al. (2017), including e.g. the flagellates, amoebae, apicomplexans and ciliates, the latter comprising the Mobilida (e.g. trichodine ciliates), considered as Ciliophora. Myxozoa belongs to the metazoans, due to DNA analysis demonstrating similarity to cnidarians (e.g. anemones, corals, jellyfish), with around 64 genera and approximately 2,500 species from hosts of tropical, temperate and polar regions (Atkinson et al. 2015, Cairns et al. 2009, Paladini et al. 2017). All these parasites have considerable importance as disease agents of fish, while species diversity and richness is mainly unknown, with many new species descriptions being published every year (Lom 2005a, b, Moodie 2005, O'Donoghue 2005, Rohde 2005). In 2005, less than 5% of the thousands of Australian fish species have been examined for these parasites and sample sizes of those that have been examined were small. Asian countries have been investigated even less (Lom 2005a, b, Moodie 2005, O'Donoghue 2005). It is

suggested that these parasites belong to the most speciose groups of fish parasites in the marine environment.

Microsporidians are characterised by spores with a unique coiled polar tube, and about 100 species were known from fish hosts in 2005. A similar number of 150 mainly ectoparasitic Ciliophora were reported until then (Lom 2005a, O'Donoghue 2005). The latter are characterised by various cilia patterns and kinetid ultrastructure, e.g. trichodinid species show a concave adhesive disc reinforced with denticles (Lom 2005a, O'Donoghue 2005).

So far, microsporeans of marine, free-living teleosts in Indonesia were recorded exclusively for Perciformes, namely for three serranid grouper species and for one scatophagid, all from the stomach, intestine or mesenteries (Kleinertz 2010, Kleinertz et al. 2014, Rückert 2006, Rückert et al. 2009b, 2010).

Almost all Ciliophora parasitising wild Indonesian fish belong to the genus *Trichodina* (Mobilida, Trichodinidae), with at least five species recorded so far from the surface and gills of perciform fish exclusively, namely an acanthurid, a haemulid, mugilid, pomacentrid and scatophagid, various serranid, three siganid and one terapontid fish species (see App. I.1, and Muthmainnah 2004, Slade 2001). *Cryptocaryon irritans* (Prorodontida, Holophryidae) was recorded for groupers as well (Diani 1989). Records of the epistylidid *Apiosoma* sp. (Sessilida) and balantidiid *Balantidium* sp. (Vestibuliferida) were provided by Awik et al. (2009) (~ Nurhayati et al. 2010, miscombining of first and surname and year of this publication in various references) for a grouper (see App. I.2, remark[59]). Sabariah et al. (2014) recorded the myxozoan *Kudoa* sp. (Kudoidae) from the gills of the perciform scombrid *Katsuwonus pelamis*, Myxozoa indet. was reported from the gallbladder of groupers (Rückert 2006, Rückert et al. 2010), and *Sphaeromyxa limocapitis* (Sphaerosporidae) was firstly described from Indonesia, isolated from the gallbladder of the berciform trachichthyid *Gephyroberyx darwinii* (Bartošová-Sojková et al. 2015).

A total of 12 different fungi (n = 1), protistian (n = 8) and myxozoan (n = 3) taxa so far were recorded in the available literature (international peer reviewed as well as `grey´ literature such as bachelor theses) for wild marine Indonesian teleosts.

1.3.3.2 Platyhelminthes

Digenea

The Digenea, together with the Aspidogastrea, comprise the trematodes (Ax 1995, Gibson 2002). In contrast to the latter, the Digenea have complex life cycles involving up to six developmental stages (with some of them being able to reproduce asexually) and up to four intermediate hosts (Paladini et al. 2017). The hermaphroditic adults have an anterior and a ventral sucker (with rare exceptions), and usually a bifurcated blind intestine. They infect all classes of marine vertebrates and asexual reproduction almost always occurs in molluscs (Cribb 2005).

> 70 families of digeneans occur in teleost fishes, mainly in the gastro-intestinal system, but also - especially larval stages - in all other organs. Adult aporocotylids live in the vascular system and didymozoids in the gills and muscle tissue (Paladini et al. 2017). Digeneans feed on mucus, epithelial cells and, sometimes, blood and intestinal contents (Cribb 2005). There were > 5,000 species known from fishes in 2005 (Cribb 2005), and 9,000 to 14,000 species in all are assumed nowadays (cf. Caira & Littlewood 2013, Littlewood et al. 2015, Palm & Bray 2014). Despite being diverse and speciose, certain groups are predominant in fish: Acanthocolpidae, Bucephalidae, Cryptogonimidae, Derogenidae, Didymozoidae (the latter also known as tissue flukes), Fellodistomidae, Hemiuridae, Lecithasteridae, Lepocreadiidae and Opecoelidae account for about two-thirds of the records (Cribb 2005). Chapter 5 (Bray et al. 2018) provides more detailed information on selected Digenea from Indonesia.

According to Cribb (2005), larger families mostly occur in a range of ecologically related host fishes, with their diet linking the distribution of their parasites. For example, bucephalids occur in dozens of piscivorous fish families, and the host range extends to hundreds of families of fishes (e.g. for Opecoelidae) (Cribb 2005).

The six fish orders Aulopi-, Clupei-, Scorpaeni-, Siluri-, Tetraodontiformes and especially a broad range of perciform fishes, mainly Carangidae, Serranidae and Scombridae, are known as hosts of Indonesian Digenea, and further 28 host fish families have been already recognised, with 86 fish species (App. I.1). 25 trematode families and 114 species, most belonging to the Bucephalidae, Didymozoidae, Hemiuridae and Opecoelidae, have been reported so far (App. I.1).

In the late 19th century the trematode *Eurycoelum sluiteri* was described as a new species with Indonesia as the type locality by Brock (1886). Then, 32 species were described from Indonesia by Yamaguti (1952, 1953b), and more recently *Haploporus magnisaccus*, *Hysterolecitha indonesiana* and *Pseudolecithobotrys stomachicola* by Machida (1996), *Lobatozoum euthynni* by Ching & Madhavi (1999), *Rhipidocotyle danai* and *R. jayai* by Bray & Palm (2009), *Balistovermis lombokensis* by Machida (2011), the three blood-flukes *Psettarium jimbaranense*, *P. ogawai* and *P. pulchellum* by Yong et al. (2016), and most recently *Bucephalus damriyasai* (Bray et al. 2018, Chapter 5 below) (n = 44 original trematode species descriptions, see Fig. 1 and App. I.1).

Monogenea

In 2005, 1,800 species (according to Hayward 2005, Whittington 2005) of these hermaphroditic gill- or surface flukes of fishes were known, and nowadays > 4,200 to 11,000 are known or assumed according to Palm & Bray (2014) and Gibson & Bray (2018). Paladini et al. (2017) mentioned 5,500 species within > 750 genera. These hermaphrodites have a direct life cycle without intermediate hosts and live mainly on the external surfaces of fish (see Theisen et al. 2017, 2018, Chapters 3 & 4) by using an posterior holdfast organ called opisthaptor (with hooks, suckers and/or clamps) for attachment. They usually show a bifurcated, blind gut. Many species show two pairs of basal pigment eye spots. They are often highly host specific and the distribution of a species is correlated to that of their particular hosts

(Hayward 2005, Whittington 2005). Tropical reef fishes seem to be less infected due to cleaning organisms (Hayward 2005, Whittington 2005, cf. Theisen et al. 2017, 2018). One of the two major taxa, the Polyopisthocotylea, feed on blood of host fish, while the other, Monopisthocotylea, feed on epithelial cells (Paladini et al. 2017). They typically do not cause serious pathological effects to wild fish, but the resistance soon weakens in crowded, less nourished farmed fishes in lower water quality, where they can lead to mass mortalities, especially due to triggered secondary infections (Shinn et al. 2015).

The six fish orders Aulopi-, Clupei-, Elopi-, Perci-, Scorpaeni- and Siluriformes have been recorded as hosts for monogeneans in Indonesia, with 68 species from 25 families (App. I.1).

Besides few taxa identified as Mono- and Polyopisthocotylea indet., and a Monogenea indet. from *Atrobucca nibe*, the 16 families Allodiscocotylidae, Ancylodiscoididae, Ancyrocephalidae, Axinidae, Capsalidae, Dactylogyridae, Diclidophoridae, Diplectanidae, Gotocotylidae, Heteromicrocotylidae, Hexostomatidae, Mazocraeidae, Microcotylidae, Monocotylidae, Protomicrocotylidae and Thoracocotylidae are so far known from Indonesia, including 74 species (App. I.1).

Important original descriptions for 32 species with Indonesia as the type locality were published by MacCallum (1917), Yamaguti (1953a), Hayward & Rohde (1999a), and Theisen et al. (2017, 2018, Chapters 3 & 4) (Fig. 1 and App. I.1).

Cestoda

The tapeworms with 5,000 to 6,000 species in 19 orders (Caira & Jensen 2017, Caira & Reyda 2005, Littlewood et al. 2015), 1,300 of them parasitic in fishes (Palm & Bray 2014), possess an anterior holdfast organ named scolex (with usually two or four suckers), which varies in shape among orders, and - as adults - a segmented strobila (chain of body segments that are named proglottids). The first intermediate host is usually a crustacean. All tissues of intermediate host fishes can be parasitised; and hermaphroditic adults inhabit the digestive tract of vertebrate definitive hosts (Paladini et al. 2017), absorbing nutrients with their tegument, lacking an inner digestive system (gut). Effects of adults on their hosts range from negligible to death, and larvae (e.g. heavy infections of trypanorhynchs and lecanicephalideans) reduce the marketability of fish fillets, being visible in the musculature by naked eye (Caira & Reyda 2005). Several cases of trypanorhynch larvae and *Adenocephalus pacificus* infecting humans are known (e.g. Bates 1990, Paladini et al. 2017) after consumption or raw seafood.

From marine habitats, > 1,400 cestode species are known, with a few orders being exclusively marine, e.g. the Diphyllidea, Lecanicephalidea and Tetrabothriidea. Some of the most speciose higher cestode taxa are predominantly marine: Bothriocephalidea and Diphyllobothriidea, Trypanorhyncha and orders newly erected from the polyphyletic, no longer recognised Tetraphyllidea (Caira & Jensen 2017, Caira & Reyda 2005). Members of the families Bothriocephalidae (65% parasitise marine fishes), Philobythiidae, Echinophallidae and Triaenophoridae parasitise the digestive system of marine teleosts. The degree of specificity for the definitive host also varies: many species are known from only a single, others parasitise tens of host fish species. Adult diphyllideans, lecanicephalideans, trypanorhynchs and members of newly erected orders from the polyphyletic, formerly recognised tetraphyllideans parasitise

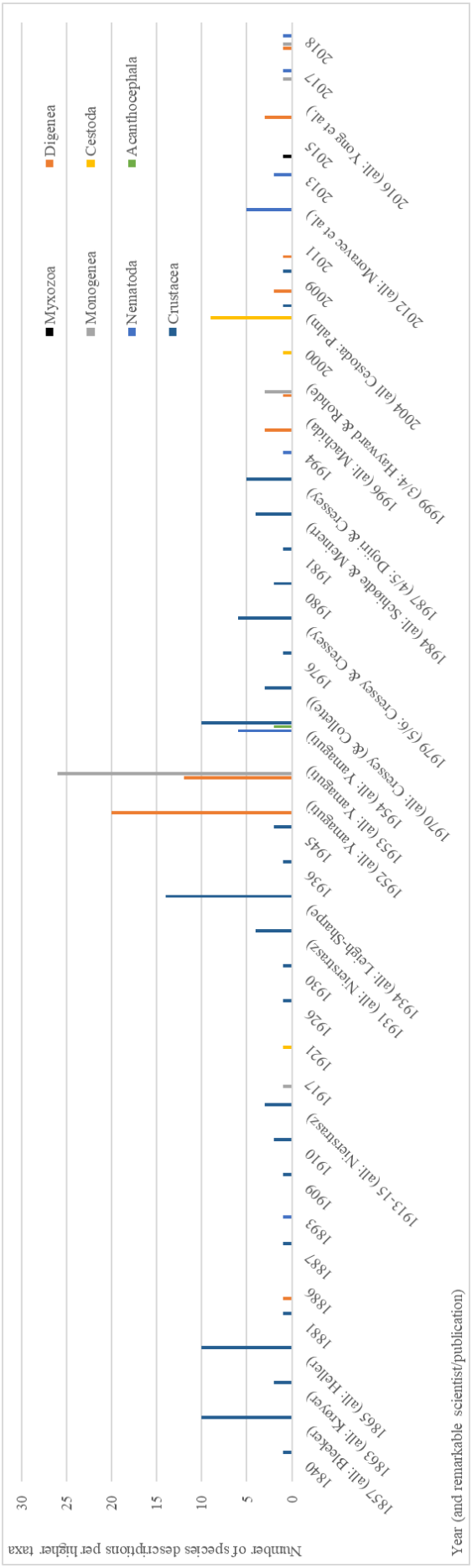

Fig. 1 Number of parasite species descriptions for Indonesian Actinopterygii: Chronologically, per publication and remarkable scientists, since 1840, 195 in total; descriptions from the author are from 2017/18 (see Chapters 2-5).

the spiral valve (~ intestine) of elasmobranchs, and tetrabothriideans the guts of mainly seabirds and cetaceans (Actinopterygii are intermediate and/or paratenic hosts) (Caira & Jensen 2017, Caira & Reyda 2005). So far, 88 fish species from 45 families and the 13 orders Anguilli-, Aulopi-, Beloni-, Beryci-, Clupei-, Gadi-, Lophii-, Ophidi-, Perci-, Pleuronecti-, Scorpaeni-, Stomii- and Tetraodontiformes have been recorded as marine cestode hosts in Indonesia (App. I.1). Additionally, trypanorhynch cestodes have been reported for anabantid *Anabas testudineus* and a channid fish, both freshwater or brackish water species (Sachlan 1952) (App. I.1).

Besides unidentifiable `pseudophyllidean´ (from mullid and serranid fish), `tetraphyllidean´ (from balistid, belonid, bramid, caesionid, carangid, gempylid, leiognathid, mullid, nemipterid, priacanthid, sciaenid, serranid, synodontid and trichiurid fish) and trypanorhynch (from freshwater and from a carangid and priacanthid fish) larvae, and various larval Cestoda indet. (from bramid, clupeid, gempylid, gerreid, mullid, nemipterid, scombrid and serranid fish), 11 families (Amphilinidae, Bothriocephalidae, Eutetrarhynchidae, Gymnorhynchidae, Lacistorhynchidae, Otobothriidae, Pseudotobothriidae, Pterobothriidae, Rhinoptericolidae, Sphyriocephalidae and especially Tentaculariidae) with 48 species have already been recorded from Indonesian marine teleosts (App. I.1).

Original cestode species descriptions from Actinopterygii with Indonesia as the type locality were published by MacCallum (1921) (*Pterobothrium tangoli*) and Palm (2000) (*Pseudogilquinia thomasi*). The book `The Trypanorhyncha Diesing, 1863´ from Palm (2004) described nine new cestode species from Indonesian ray-finned fishes (Fig. 1). The fish orders Anguilli-, Gadi-, Lophii-, Ophidi- and Stomiiformes as local cestode hosts appear exclusively in this work, and 21 of 48 cestode species from 46 of 90 fish species were exclusively mentioned in this work from Indonesian waters (Palm 2004). One further species appears to be new, yet undescribed, namely Rhinoptericolidae indet. sp. nov. from Theisen (2009).

Summarised for the Platyhelminthes, at least 114 trematode species, 74 monogenean species, and a minimum of 48 cestode species, resulting in 236 platyhelminth species from wild Indonesian Actinopterygii, are so far known (App. I.1).

1.3.3.3 Nematoda

With > 40,000 species, nematodes are most successful, sexually dimorphic (~ dioecious) animals (Anderson 2000, McClelland 2005). They are called roundworms because of their morphological shape, taking the form of an elongate cylinder (Anderson 2000, McClelland 2005, Paladini et al. 2017) (only Acanthocephala (see below) look similar, but nematodes lack an anterior proboscis). They have a mouth and an open gut with an anus. Many have a complex life cycle with various intermediate hosts, e.g. one intermediate host and a fish either as final or as second intermediate host (Paladini et al. 2017). Here, only marine parasites of the Actinopterygii are summarised: capillarids (e.g. (*Para*/*Pisci*/*Pseudo*-) *Capillaria* spp.) are abundant in the alimentary canal of elasmobranchs and ray-finned fish (McClelland 2005, Moravec & Barton 2018). Ascarididans are parasites of the gastro-intestinal tract of all classes of vertebrates including marine fishes. Together with the nematode family Anisakidae, they are the most numerous and diversified members of the group (McClelland 2005). *Anisakis*, *Contracaecum* and *Pseudoterranova* spp. parasitise marine mammals, their larvae occur in teleosts, while *Goezia* spp. (Goeziinae) are parasites of marine ray-finned fish. Spiruridans are the most diversified group among marine parasitic nematodes, with the marine camallanoids (*Pro*/*Spiro*-)*Camallanus* from the gastro-intestinal system of ray-finned fishes (Moravec et al. 1999, Rigby & Adamson 1997, Sardella et al. 2017). Marine dracunculoids belonging to the Philometridae (e.g. (*Spiro*-)*Philometra*/*-troides* spp.) infect a broad spectrum of ray-finned fish, e.g. subcutaneously in the fins and opercula, in the musculature, in the body cavity, on the liver, gonads and mesenteries (Dewi & Palm 2013, 2017, McClelland 2005, Moravec et al. 2002, 2016). *Rasheedia* spp. are known from the intestines of ray-finned fish (Moravec & Justine 2018). Marine cystidicolids (e.g. *Spinitectus*/*-toides* spp.) usually occupy the stomach and gastro-intestinal ducts of ray-finned fish (McClelland 2005, Rocka & Stefanski 2002).

Pathogenesis of adult ascarididans is confined to the gut of marine vertebrate hosts; lesions or haemorrhages in the gastric or intestinal mucosa have been found in association with raphidascarines (e.g. *Hysterothylacium* spp.), goeziines and cucullanids of ray-finned fishes (Rohde 1984, Williams &

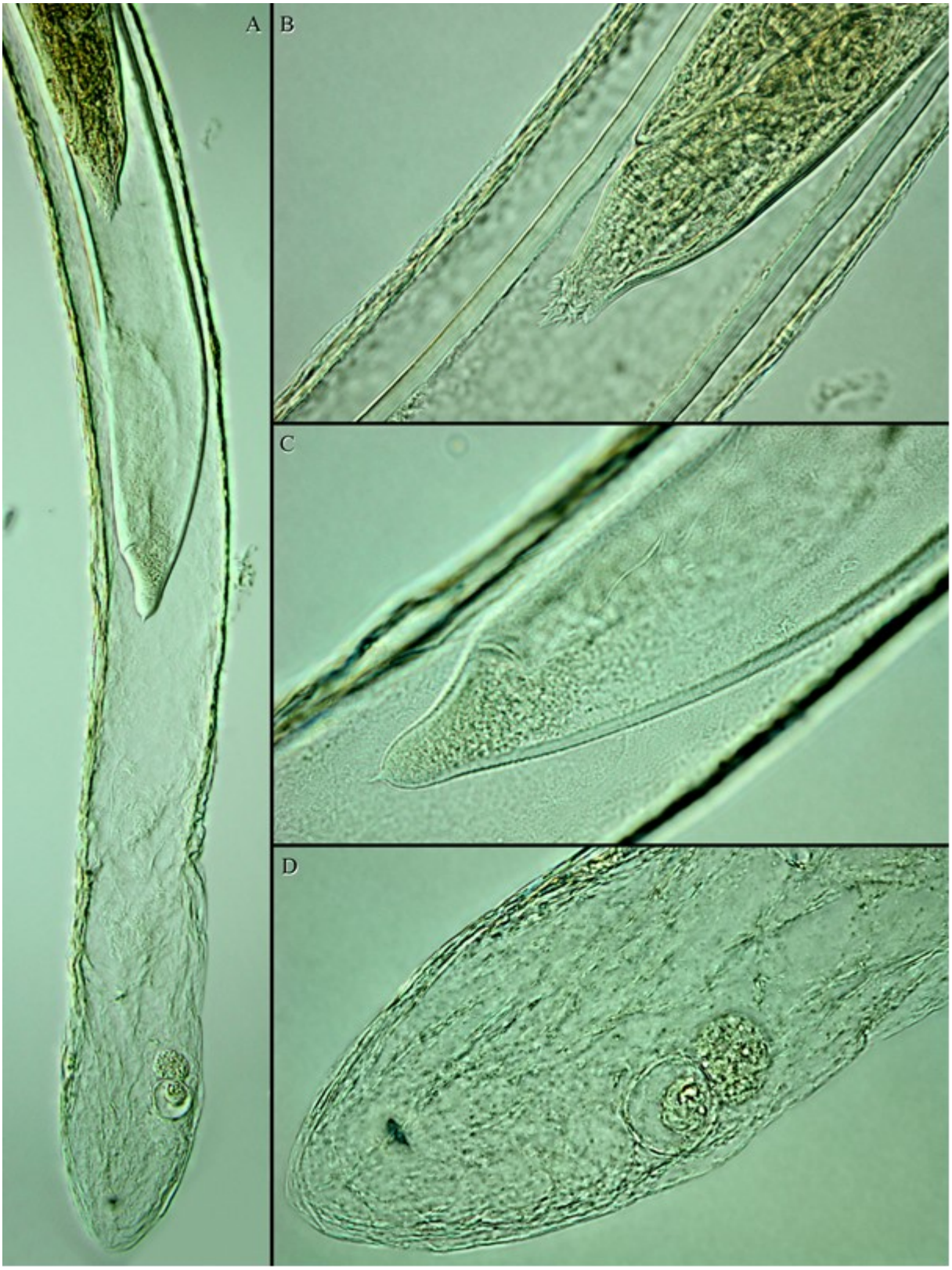

Fig. 2 Posterior morphological characteristics of Indonesian *Hysterothylacium*: Morphological characters of the tail vary during larval development within a single species. A & B: Cactus-tail larva (3rd stage) within the cuticula of the 2nd larval stage with terminal mucron (C), surrounded by a terminally rounded older sheath (from 1st stage larva) (D).

Jones 1994). Although reports on the pathology of *Spirocamallanus* spp. (Camallanidae) in the gut of marine fish are lacking, *Camallanus* spp. have proven lethal in aquarium fishes (McClelland 2005), due to the buccal capsule of these `milling head´ worms (Paladini et al. 2017). Among dracunculoids, *Philometra* spp. may cause visceral oedema, granulomata, adhesions, and castration via atrophy of the ovaries (Hesp et al. 2002, Palm et al. 2018, Rohde 1984). Various larval anisakids/raphidascaridids (*Anisakis*, *Contracaecum*, *Pseudoterranova*, *Hysterothylacium* spp.) cause necrosis of the liver, gut wall, viscera and musculature, depletion of lipids and mortality in heavily infected marine fish (Rohde 1984, Williams & Jones 1994).

Anisakis spp. can cause anisakiasis, an inflammation of the human gastro-intestinal system, when infected raw fish is eaten (Paladini et al. 2017, for details see Palm & Theisen et al. 2017, Chapter 2). Other zoonotic fish parasitising nematodes in the region are members of the genera *Capillaria* and probably *Echinocephalus* (cf. Paladini et al. 2017). Aside from their medical significance, larval anisakids and heavy nematode burdens also represent a chronic and costly cosmetic problem for seafood processors (McClelland 2002, Paladini et al. 2017).

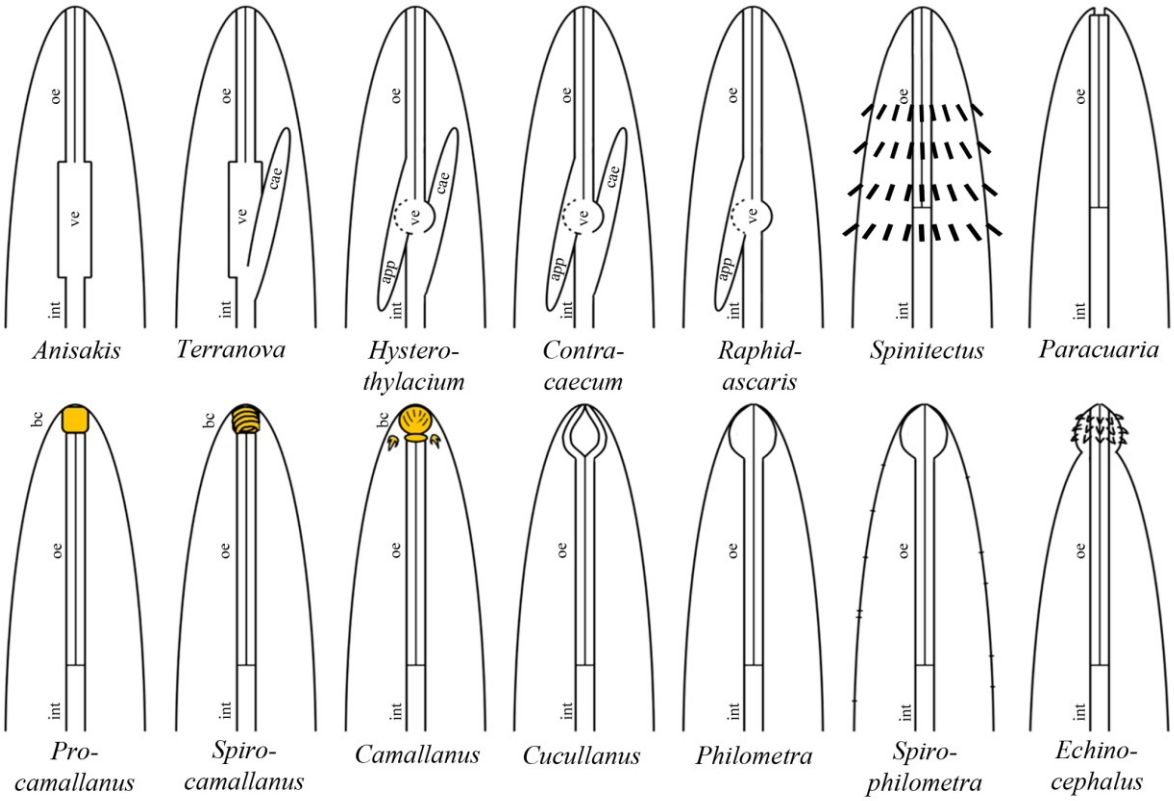

Fig. 3 Nematoda (sub)genera abundant in Indonesia: Schematic illustrated morphological anterior characteristics for identifying the most important nematode groups in the area. In *Hysterothylacium*, the ventral excretory pore lies at the level of the nerve ring, while in *Contracaecum* (probably not present in Indonesia), it lies at the level of the larval tooth (not shown, see Fig. 106 in Möller & Anders 1986). *Capillaria* is not shown; it is small, filiform, anteriorly narrow and easily recognizable by the large eggs, which are arranged in the longitudinal direction of the female body and resemble a string of pearls. Abbreviations: app: appendix, bc: buccal capsule, cae: caecum, int: intestine, oe: oesophagus, ve: ventricle.

Nematodes from free-living marine Indonesian Actinopterygii have been reported for Aulopi-, Beloni-, Clupei-, Elopi-, Perci-, Pleuronecti-, Scorpaeni-, Siluri- and Tetraodontiformes, with 107 fish species from 40 families, mainly Carangidae, Mullidae, Nemipteridae, Scombridae and Serranidae (App. I.1).

With identity corrections, e.g. updated taxonomy for published taxa (cf. discussion & App. I.1-2), with six *Anisakis* species (respective genotypes) and five *Hysterothylacium* spp., 39 nematode species from 11 families are counted as parasites of wild Indonesian teleost fishes (App. I.1-2, Figs. 2-3, and discussion Chapter 1.4.3).

Original first descriptions from the Actinopterygii with Indonesia as the type locality were published by Jägerskiöld (1893) for *Philometra pellucida*, by Yamaguti (1954c) for four cucullanid species, the camallanid *Procamallanus annulatus* and for the raphidascaridid *Hysterothylacium arii*, by Machida & Syahailatua (1994) for the cystidicolid *Mastigospirura cubicipitis* (*nomen dubium*, see discussion in Chapter 1.4.3 below), for *Philometra javaensis*, *P. lobotidis*, *P. psettoditis*, *Philometroides indonesiensis* and *P. trichiuri* by Moravec et al. (2012), for *Philometra epinepheli* and *Spirophilometra endangae* by Dewi & Palm (2013) and finally for *Philometra damriyasai* by Dewi & Palm (2017) (Fig. 1).

1.3.3.4 Acanthocephala

Acanthocephalans, with > 1,000 sexually dimorphic species, mature in vertebrate final hosts. About half of the acanthocephalan species parasitise fish, and very few become adult in squids (Taraschewski 2005). The worms are tubiform, sometimes pseudosegmented, reach a length up to a few centimetres in fish, and are differentiated from nematodes by e.g. the presence of a so-called proboscis, a spiny holdfast organ for attachment inside the intestinal wall. The shape and patterns of the proboscis hooks are relevant for species identification (Paladini et al. 2017), and can be investigated (e.g. counted and measured) in worms relaxed in chilled tap water (Taraschewski 2005). Similar to cestodes, they do not have a mouth and an intestine, but absorb nutrients through their surface tegument.

For the Echinorhynchida (an order containing most important Acanthocephala families such as the Echinorhynchidae and Rhadinorhynchidae), fish serve as final hosts, infected by foraging on amphipods, while paratenic hosts are not necessary, but common (e.g. juvenile or mature worms are transmitted to another, second fish host where they re-attain intraintestinal) (Taraschewski 2005). Final host specificity may be narrow or wide. Long necked acanthocephalans deeply penetrate into (or through) the intestinal wall and are more pathogenic than species with a short neck (Taraschewski 2005). However, in fish, dense infrapopulations form considerable biomass, but cause no mortality (Taraschewski 2005). Human infections by marine acanthocephalans are rare and harmless (cf. Paladini et al. 2017). They have a high accumulation capacity for (heavy) metals, which makes them useful as biological indicators (cf. Nachev & Sures 2016, Palm 2011), and probably beneficial for the host (symbiont). They can also be used as biomarkers for organic pollutants via molecular-chemical screening by pyrolysis-field ionisation mass

spectrometry (Kleinertz et al. 2016). Application of this methodology allows the detection of small-scale variations within the chemical compounds of the acanthocephalans.

The fish orders Aulopi-, Perci-, Pleuronecti-, Scorpaeni- and Tetraodontiformes, with 36 species from 20 families (especially Nemipteridae, also Serranidae), are so far known to harbour eight acanthocephalan families with 16 species, especially of the Rhadinorhynchidae, in Indonesia (App. I.1). These numbers result from the published literature (considering corrections according to discussion, Chapter 1.4.4 and App. I.2). In Kleinertz et al. (2016), we provided the first locality record of *Rhadinorhynchus zhukovi* from Indonesia with *Auxis rochei* and *A. thazard* as new host records.

The two species *Gorgorhynchus celebesensis* and *Neoechinorhynchus longilemnicus* were originally described for Indonesia as the type locality, both by Yamaguti (1954b).

Many taxa have been published as Acanthocephala indet., e.g. because they were collected as larvae and/or because the proboscis as the most important character for species identification was invaginated (compare e.g. Hariyadi 2006, Pradipta 2012, Rückert 2006, Rückert et al. 2009b, Sabariah et al. 2014, Silaban 2012, Tamba et al. 2012). Actinopterygii play a major role as intermediate hosts for many acanthocephalans, and they are often not host specific to them (e.g. *Serrasentis sagittifer* is reported from nine fish families of three orders, App. I.1). Because not further identified acanthocephalans occur in various different hosts locally, the number of countable (e.g. less identified and probably similar) species in App. I.1 is comparably low (n = 16). Contrary, some species are host specific, especially to their final hosts, e.g. *Filisoma indicum*, *F. longcementglandatus*, *F. rizalinum* and *F. scatophagusi* to the Spotted scat *Scatophagus argus* (see Amin & Nahhas 1994, Amin et al. 2014, Datta & Soota 1962, Kleinertz 2010, Rückert et al. 2009a, Tubangui & Masiluñgan 1946, Verweyen et al. 2011, Yamaguti 1954b, Yuniar 2005).

1.3.3.5 Hirudinea

The Euhirudinea or `true´ leeches, a subclass of annelids, consist of two groups, with the Rhynchobdellida including the marine (and freshwater) families Piscicolidae, Ozobranchidae and Glossiphoniidae (Govedich et al. 2005). They have an annelid morphology with eye spots and body segmentation, are hermaphroditic and are characterised by an anterior oral sucker with a mouth (with an open intestine) and a wider ventroposterior sucker (Govedich et al. 2005). Glands in the sanguivorous leeches secrete compounds used for bloodsucking, including mucus to lubricate the mouth, a hyaluronidase to permeable the host skin, a histamine-like secretion for blood vessel dilation and an anticoagulant preventing blood clots (Govedich et al. 2005).

Adult marine leeches are often found attached to the gill chamber or fin bases of fish, e.g. on salmons and groupers. Most species leave their hosts to reproduce. Free-living adults are often found in estuaries where they mate and die after reproduction. Newly infected hosts may move out of estuaries carrying the leeches with them (Govedich et al. 2005).

High densities of marine leeches can reduce the value of economically important fish (Cruz-Lacierda et al. 2000). However, according to Paladini et al. (2017), they rarely cause issues on fish farms. They can be an integral part of the benthic and pelagic communities with piscicolid, glossiphoniid, hirudinid and haemadipsid species acting as temporary ectoparasites (sanguivory) on fish, where they are not host specific and infect a range of available hosts (Govedich et al. 2005), which they usually do not harm (lethal cases are known (Cruz-Lacierda et al. 2000)), leaving the host following a blood meal. Some marine leeches spend most of their life on a host, leaving it only to reproduce. Leeches can serve as vectors of haematozoans (e.g. trypanosomes) (Govedich et al. 2005).

So far, only perciform fish of five genera, with seven commercially important free-living fish species have been recorded as hosts in Indonesia, most of them from brackish water environments (Segara Anakan mangrove lagoon, compare Yuniar (2005)) or from mariculture surroundings (e.g. Hennersdorf et al. 2016, Rückert 2006, Rückert et al. 2009a). All of them seem to belong to the Piscicolidae, with *Zeylanicobdella arugamensis* as the only identified species from various fish hosts and localities. A second species, *Stibarobdella macrothela*, was recorded from Indonesian marine environments without a host by Blanchard (1897), but it is known to parasitise the shark *Carcharhinus brachyurus* in southern Brazilian waters (Soto 2000).

1.3.3.6 Crustacea

Copepoda and Branchiura

Of all parasites reported in this thesis, the sexually dimorphic crustaceans are the most diverse and abundant, with the copepods being a most speciose group of metazoan ectoparasites of marine fishes (besides endoparasitic Digenea, see Chapters 1.3.3.2 & 1.4.2). Parasitic crustaceans have eyes (or eye spots), are segmented, have a mouth, an open intestine and a direct life cycle with only one (fish) host. Of the almost 65,000 Crustacea species, more than 8,000 have parasitic life stages (Paladini et al. 2017), and 5,750 are fish parasitic crustaceans (Palm & Bray 2014). Within about 11,500 copepod species known, half of them are symbiotic or parasitic (Boxshall 2005). These parasites utilise a broad range of hosts and microhabitats. Of nine orders, four contain parasitic species, either entirely parasitic (Monstrilloida), largely parasitic (Siphonostomatoida and Cyclopoida) or with few parasitic forms (order Harpacticoida) (Boxshall 2005). About 30 families are found exclusively on fishes, with some inhabiting sheltered microhabitats, e.g. the gill chambers and nostrils. Other species occur on the outer body surface, the fins or around the eyes. With > 470 species, the Caligidae is the most speciose family, including the economically very important sea lice (Boxshall 2005). Families such as the Kroyeriidae, Hatschekiidae, and Lernanthropidae can be found on a wide range of actinopterygian fishes. Most species within these families inhabit the gills (Boxshall 2005). Adult lernaeopodid females are permanent parasites whereas their tiny dwarf males hold on to them (Boxshall 2005). The Philichthyidae inhabit the sensory canals of the lateral line and skull bones of their hosts (Boxshall 2005).

The infected host is damaged directly by the attachment mechanisms and feeding activities of host tissue or blood, extracting nutrients (Boxshall 2005, Paladini et al. 2017). The clawed limbs penetrate the skin and cause lesions, necrosis and hyperplasia, while surface lesion also cause secondary infections. Gill filament attachment results in hypertrophy and loss of respiratory area (Boxshall 2005). Eye parasites cause blindness. Caligid sea lice, especially the genera *Lepeophtheirus* and *Caligus*, are pests in fish aquaculture, causing severe economic losses, e.g. reduced marketability and value (Paladini et al. 2017). This is less pronounced in wild fish, where their value can also be reduced (Boxshall 2005). The presence of paired egg sacs is a useful character for the identification of a copepod as such, also of species with the lack of other morphological characteristics.

For copepods of free-living marine Indonesian Actinopterygii, so far 13 teleost orders, 52 families and 117 species, mainly Carangidae, Nemipteridae, Scombridae and especially Serranidae, have been reported. 131 copepod species from 14 families have been recorded as parasites of wild, Indonesian Actinopterygii. In addition, many records were published for Caligidae indet., Bomolochidae indet. and Pennellidae indet., occurring in the larval chalimus stage. Consequently, the real species number is much higher, especially with respect to the high host specificity (e.g. Bomolochidae indet. from the Sciaenidae is the only reported bomolochid from this fish family, and thus most likely represents a distinct species, even though many bomolochids were identified for other fish families). The five copepod species *Bomolochus efficatus*, *Caligus coryphaenae*, *Ceratochondria brevicollis*, *Ergasilus borneoensis* and *Euryphorus brachypterus* were recorded without hosts from Indonesia.

Original first copepod species descriptions from the Actinopterygii with Indonesia as the type locality were published by Krøyer (1863) (n = 2), Heller (1865) (n = 10), Richiardi (1881a) (n = 1), Leigh-Sharpe (1930, 1934) (n = 15), Markewitsch (1936) (n = 1), Heegaard (1945) (n = 2), Yamaguti (1954c,d) (n = 10), Cressey & Collette (1970) (n = 3), Cressey & Cressey (1979, 1980) (n = 7) and Dojiri & Cressey (1987) (n = 4). Thus, 55 copepods so far have been described with Indonesia as the type locality.

The Branchiura occur in fresh water, but a few species of the genus *Argulus* parasitise marine fish (Rohde 2005). Only *Argulus belones* has been reported from Indonesia, firstly described from the belonid Flat needlefish *Ablennes hians* with Indonesia as the marine type locality (Van Kampen 1909) (Fig. 1).

Isopoda

Parasitic isopods are typically marine species, sexually dimorphic, and primarily found in warm waters, where they infect fish and other crustaceans. Two major taxa, the cymothoids and gnathiids, are parasites of fish, the latter as larvae only. Cymothoids are commonly seen on teleosts in tropical waters, attached to the body surface, in the mouth or on the gills (Brusca 1981, Bunkley-Williams & Williams 1998, Lester 2005, Paladini et al. 2017). Other families can be fish parasitic, namely the Aegidae, Barybrotidae (parasites of sharks and rays) and Corallanidae (mostly free-living with few fish parasitic forms) (cf. App. I.1). Cymothoids harm the fish in several ways, e.g. can kill fry and fingerlings through caused tissue damage, can stunt fish growth and inhibit reproduction, cause stunted gills (atrophy, anaemia),

affect the development of oral structures and may completely replace the tongue (tongue biter isopods, see Lester (2005)). Problems caused by cymothoid isopods in the worldwide aquaculture sector were mentioned in Paladini et al. (2017) and summarised by Martin (2015). Larval parasites of the isopod family Gnathiidae are abundant on the gills of tropical marine fishes and represent a primary source of food for cleaner fish (Lester 2005, Rohde 2005). They feed on the host piercing into its tissue to penetrate blood vessels or sinuses (Paladini et al. 2017). They are called praniza larvae (Paladini et al. 2017), and are unidentifiable because their taxonomy is based on the adult, free-living males. The pranizae may only remain for a few hours on the fish for feeding. A good way to identify praniza larvae is to keep them in clean seawater until one moults into an adult male, which can then be identified (Lester 2005).

Isopods of free-living marine Indonesian Actinopterygii have so far been reported from 67 fish species belonging to 36 families (mainly from Serranidae) and 11 fish orders. The five families Aegidae, Barybrotidae, Corallanidae, Cymothoidae and Gnathiidae have been reported from Indonesia. However, all aegids were collected either without a host or from the milkfish *Chanos chanos* from brackish or fresh water environments (even though milkfish also occurs marine). Barybrotidae were also recorded without a host, but are common parasites of sharks and rays. Thus, only the remaining three families are parasites of wild Indonesian marine Actinopterygii. Without considering the freshwater species *Alitropus typus* from milkfish, the manta ray parasite *Barybrotes indus*, as well as *Aega vigilans* and various *Aegathoa* spp. (all considered as a *nomen dubium*, e.g. because *Aegathoa* is a `form´ genus, the species of which are immature Cymothoidae, according to World Register of Marine Species) (Boyko et al. 2018), 78 species have been recorded from wild marine Indonesian ray-finned fish (or without a host, but are likely from marine teleosts, cf. App. I.1). Other records were published as Cymothooidea indet. and especially Gnathiidae indet. (App. I.1), through their occurrence as e.g. unidentifiable (praniza) larvae. The real species number of Gnathiidae indet., counted as just one species in the checklist in App. I.1, even though they have been recorded from 28 fish species already, is probably much higher, even though gnathiids are less host specific than some cymothoids or copepods.

Original first descriptions with Indonesia as the type locality were published for 32 isopod species (plus two further taxa, both considered as a *nomen dubium* each). However, for only two of them, a fish host was also reported (App. I.1).

1.3.4 Working Hypotheses

This dissertation explores the following working hypotheses:

1) Indonesia encounters a high marine biodiversity. The current knowledge on fish parasites from Indonesia is scarce, and requires future attention.
2) New species descriptions, locality and host records can be made.
3) Newly applied methods and molecular analyses demonstrate an even higher species biodiversity of the so far recorded parasites, with the recognition of different genotypes for specific morphotypes.
4) Knowledge of the fish parasite species from Indonesian waters enables conclusions to be made on zoogeographical distribution patterns of fish parasites in the world´s oceans.
5) Most so far known fish parasite records originate from aquaculture or commercially exploited fish. A summary of the current state of knowledge in the form of a host-parasite checklist enables evaluation of the potential risk from fish parasites to the aquaculture and fisheries industry in Indonesian coastal waters.

This work significantly contributes to a better understanding of the fish parasite fauna and marine biodiversity of the Western Central Pacific and the Indian Ocean. The obtained results are discussed in the context of an earlier fish-parasite checklist for Indonesian marine aquaculture (Kleinertz & Palm in prep., available in Kleinertz 2017), and are compared with a recent parasite species compilation from Hawaiian waters in the Central Pacific (Palm & Bray 2014).

1.4 Overall Discussion

1.4.1 Biodiversity of Fish Parasites in Indonesia

The biodiversity and species richness of Indonesian marine fish parasites recorded so far was summarised in the introduction. This overview is completed here under consideration of the new results. Comparisons are made with the host-parasite checklists for marine Indonesian aquaculture fish by Kleinertz and Palm (in prep., available in Kleinertz 2017) and from Hawaiian waters (Palm & Bray 2014), under consideration of Chapters 2 to 5 (Palm & Theisen et al. 2017, Theisen et al. 2017, 2018, Bray et al. 2018).

One terapontid and one clupeiform (pristigaterid) fish are herewith for the first time recorded as hosts for microsporeans in Indonesian waters, and another terapontid fish for the Ciliophora (data from the First Educational Workshop on Marine Fish Parasites in Indonesia, Bali, 2013, App. I.1). For the Myxozoa, four fish orders (beloni-, clupei-, scorpaeni- and tetraodontiform) and 14 fish families are herewith newly reported as hosts (App. I.1). Four myxozoan families are newly reported, with six new genera. The unidentified myxozoans from Rückert (2006) and Rückert et al. (2010) most likely belong to *Ceratomyxa*, due to the infected host species and organ (see remark[1] of App. I.2).

Additionally, the parasite checklist for Indonesian mariculture fish (Kleinertz & Palm in prep., available in Kleinertz 2017) is expanded with a trichodinid and kudoid host record from aquacultured *Psammoperca waigiensis*.

Dr. Terry Miller trained the participants during the Bali workshop in 2013 in myxozoan isolation (and identification) from fish, mainly from the gallbladder, and many more families, e.g. Ceratomyxidae, Myxidiidae, Myxobolidae, Ortholineidae and Sphaerosporidae, with the genera *Ceratomyxa*, *Henneguya*, *Myxidium*, *Myxobolus*, *Ortholinea* and *Sphaerospora* (latter two from urinary bladder), were identified. *Kudoa* sp. was known from the gills only, while new records are from the musculature. This increases the total number of these taxa from Indonesian teleosts to **17** (one microsporean, eight ciliophoran species and eight myxozoan genera) (83 records of **11** families), and the number of infected fish host families to **22** including **38** species, resulting in 0.5 parasite families per infected fish family, and in almost 0.5 parasite species per infected fish species (cf. Figs. 4 & 5).

While the Serranidae are regular hosts for these taxa due to more research effort on these commercially important fish, it is noteworthy that Tetraodontidae, only rarely investigated for these parasites, seem to harbour a comparable high diversity of them (App. I.1).

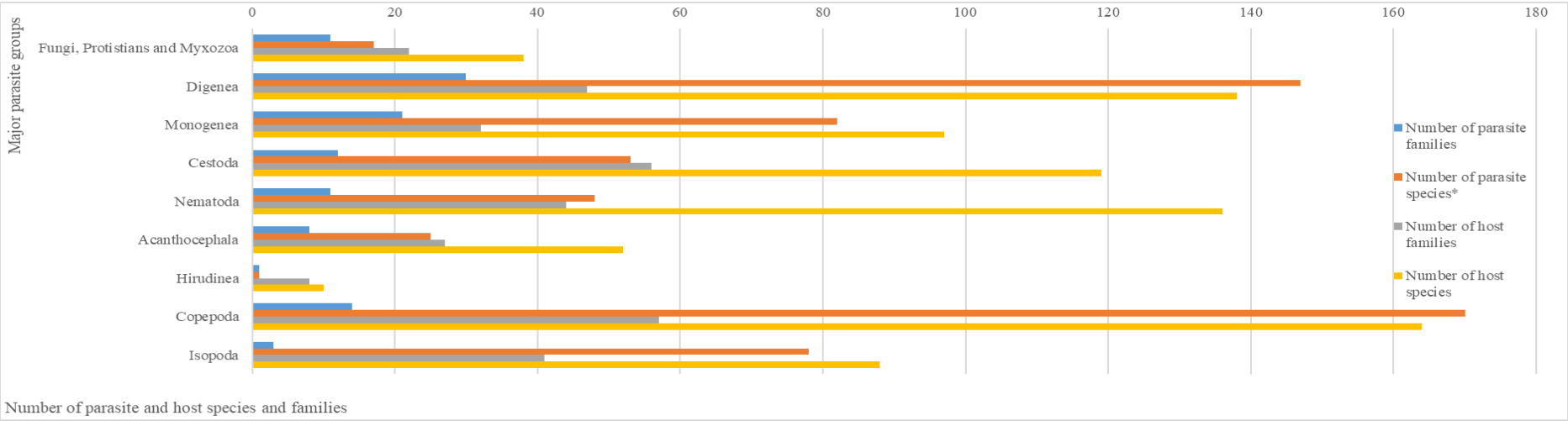

Fig. 4 Number of parasite and host species and families: In total, 621 parasite species from 111 families are now known for free-living marine Indonesian teleosts (*also genera etc., where double counts can be ruled out, e.g. when only one taxa from a genus is recorded, it is recognised and counted as `species´).

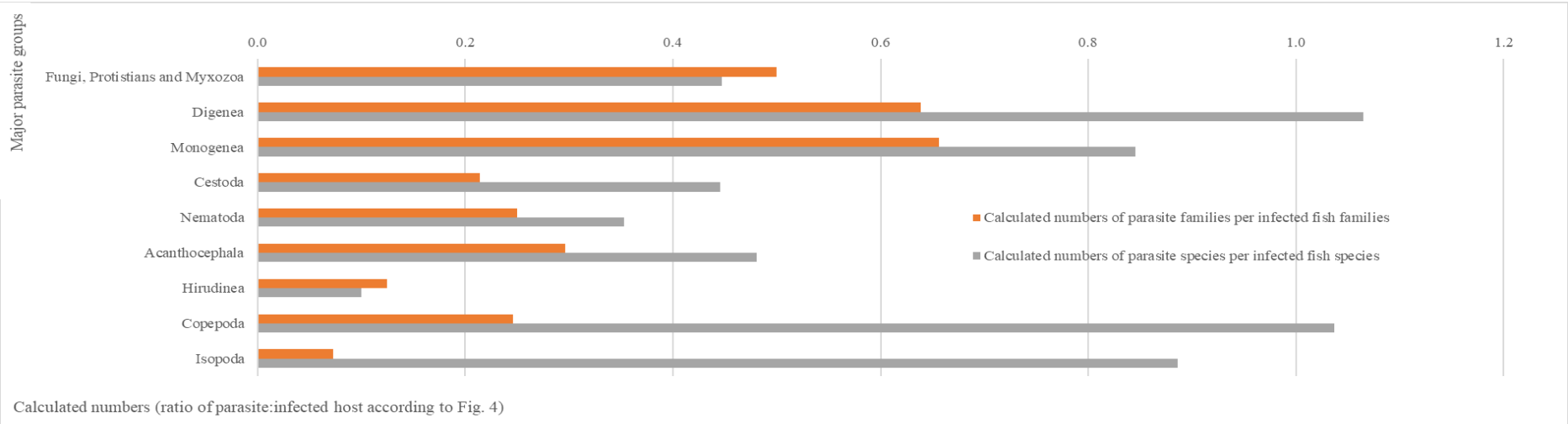

Fig. 5 Calculated numbers for the ratio of parasite species and families per infected fish species and families: The ratio of parasite per infected host is calculated based on the numbers presented in the discussion parts and in Fig. 4; e.g. for Digenea, 147 species are distributed in 138 infected fish species (147/138 = 1.07), and for Isopoda, three parasite families occur in 41 infected fish families (= 0.07).

1.4.2 Platyhelminthes - with Focus on Evolution and Zoogeography of Endoparasitism in the Monogenea; New Digenea and Cestoda Species

Digenea

With new host records from the Beloni- and Pleuronectifomes in Indonesia, fish host orders with digeneans increase from six to eight, families with the Acanthuridae, Ambassidae, Balistidae, cf. Centrolophidae, Chirocentridae, Cynoglossidae, Exocoetidae, Latidae, Malacanthidae, Monacanthidae, Monodactylidae, Pristigateridae, Scorpaenidae, Sparidae and Terapontidae, from 31 to **47**, and species from 89 to **138** (App. I.1, Fig. 4).

Recorded trematode families herewith increase from 25 to **30** (new family records for the Accacoeliidae, Atractotrematidae, Gorgoderidae, Heterophyidae and cf. Strigeidae), and recorded species from 114 to 145 (App. I.1). Additionally, according to the remarks[2&4] (App. I.2), *Bivesicula* sp. from a synodontid host might represent *B. synodi* (host specific), and thus a different species compared to *Bivesicula* sp. from groupers (then, $n^{species}$ = 146). *Alcicornis* sp. from a scombrid host is suggested to represent *Alcicornis scomberi* (host specific to this family), and thus a different species to *Alcicornis* sp. from a carangid fish species (then, $n^{species}$ = **147**) (App. I.1-2, Fig. 4).

The parasite checklist for Indonesian mariculture (Kleinertz & Palm in prep., available in Kleinertz 2017) is herewith expanded, with records of an aporocotylid and two cryptogonimids from aquacultured Sand perch *Psammoperca waigiensis*.

With this study, 512 trematode records are listed from Indonesian waters, 183 of them new. 0.6 digenean families are recognised per infected fish family, with 1.07 fluke species per infected marine Indonesian teleost species (App. I.1, Figs. 4 & 5).

Fish host species	Host ecology*	Host economic value*	Locality	Reference
Parastromateus niger (Carangidae)	Coastal, estuaries, schooling	Highly commercial	Karachi, Pakistan	Bilqees & Khatoon 2003
Pomadasys maculatus (Haemulidae)	Coastal, brackish, over sand and near reefs, migratory	Commercial fisheries	Cilacap, Java	Rahmawati 2013, **present study**
Pomadasys argenteus (Haemulidae)	Coastal, estuaries	Commercial fisheries	Bengal, India	Hafeezullah 1975, Gibson 2002
Lutjanus monostigma (Lutjanidae)	Reefs, close to caves or large coral formations, usually solitary	Commercial fisheries & aquaculture	Puri, India	Gupta & Gupta 1987
Johnius amblycephalus (Sciaenidae)	Coastal, estuaries	Minor	Kedonganan, Bali	**Present study**
Johnius carutta (Sciaenidae)	Coastal, brackish, estuaries	Less commercial	Bengal, India	Hafeezullah 1975, Gibson 2002
Johnius coitor (Sciaenidae)	Coastal, estuaries	Less commercial	Cilacap, Java	Theisen 2009, **present study**
Johnius glaucus (Sciaenidae)	Coastal, muddy bottoms	Commercial fisheries	Karachi, Pakistan	Bilqees 1971
Otolithes ruber (Scianidae)	Coastal, brackish, amphidromous	Commercial fisheries Game	Karachi, Pakistan	Bilqees et al. 2009
Nibea soldado (Sciaenidae)	Coastal waters, brackish, estuaries	Commercial fisheries	Cilacap, Java	**Present study**
Rastrelliger kanagurta (Scombridae)	Coastal bays, deep lagoons, forms schools	Highly commercial, Game	Karachi, Pakistan	Sahai & Srivastava 1978
Anyperodon leucogrammicus (Serranidae)	Coastal lagoons, and seaward reefs, solitary	Less commercial, Game	Kedonganan, Bali	**Present study**
Sillago sihama (Sillaginidae)	Coastal, brackish, estuaries, along beaches and sandbars, schooling	Commercial fisheries & aquaculture	Bengal, India	Hafeezullah 1975, Gibson 2002
Acanthopagrus berda (Sparidae)	Coastal, brackish, migrant	Commercial fisheries, Game	Cilacap, Java	**Present study**
Terapon jarbua (Terapontidae)	Coastal, sandy bottoms, estuaries, forms loose aggregations	Commercial aquaculture	Bengal, India	Hafeezullah 1975, Gibson 2002

Tab. 1 *Qadriana* hosts and locality records: All known records of the fish parasitic trematode genus *Qadriana*, from Pakistan, India and Indonesia, with host ecology and economic value (*data from Froese & Pauly 2018).

Carangidae, Serranidae and Scombridae are regular hosts for the digeneans, being frequent targets of fish parasitological investigations due to their high commercial value (App. I.1). However, only the former two families are hosts for bucephalids, while the latter family serves as most important hosts for the didymozoids; serranids are less infected by hemiurids but are the most important hosts for opecoelids (App. I.1).

Bray et al. (2018, Chapter 5) provide detailed information on bucephalid trematodes parasitising groupers and trevallies in Indonesia, with the description of a new species of the genus *Bucephalus*. This genus includes 48 marine and also other species from freshwater. They are characterised by having a sucker-like rhynchus with a hood bearing tentacles.

Host & organ measured (Ø in mm)	*Acantho-pagrus berda*	*Johnius coitor*	*Nibea soldado*	*Pomadasys maculatus*
Soma	2.761	2.268	3.776	1.933
Body width	0.729	0.819	1.184	0.871
Ecsoma	0.389	1.184	1.055	0.860
Oral sucker W	0.227	0.265	0.321	0.286
Oral sucker L	0.230	0.294	0.314	0.256
Ventral sucker W	0.493	0.644	0.784	0.761
Ventral sucker L	0.482	0.642	0.800	0.717
Pharynx W	0.104	0.130	0.138	0.125
Pharynx L	0.113	0.160	0.161	0.136
Testes W	0.133	0.159	0.190	0.185
Testes L	0.164	0.190	0.286	0.211
Ovar W	0.168	0.127	0.209	0.135
Ovar L	0.223	0.164	0.246	0.192
Seminal vesicle W	0.046	0.082	0.073	0.058
Seminal vesicle L	0.074	0.110	0.135	0.105
Egg W	0.013	0.013	0.011	0.012
Egg L	0.019	0.020	0.021	0.022

Tab. 2 Indonesian *Qadriana* measurements: The darker grey, the higher, and the darker green, the lower is the respective value, indicating that specimens from the sciaenid hosts *Johnius coitor* and *Nibea soldado* are different. Ø: arithmetic mean, L: length, W: width.

Qadriana, a genus of the family Hemiuridae, only consists of four valid species, and three more taxa that are all considered as *species inquirenda*. The author recorded this genus for the first time from Indonesia in 2009 (Theisen 2009) in a sciaenid host. It was then mentioned from a haemulid host in the bachelor thesis by Rahmawati (2013), and is herewith reported for a haemulid, three sciaenid, a serranid and a sparid host from Indonesia. Tab. 1 provides a complete overview of all known host and locality records of *Qadriana* spp. Unfortunately, most species descriptions are incomplete (e.g. Bilqees 1971, Bilqees & Khatoon 2003, Bilqees et al. 2005, 2009, 2011, Hafeezullah 1975, 1985, Sahai & Srivastava 1978). Gibson (2002) reviewed *Q. zakiae* and provided a detailed redescription. This thesis includes measurements of the Indonesian material (Tab. 2).

Monogenea

With a new host record from a Pleuronectiformes, the cynoglossid *Cynoglossus* cf. *arel*, known fish host orders with monogeneans in Indonesia increase to seven. New fish family records for the Monogenea from Indonesian waters are the Ephippidae (with *Platax teira*), Haemulidae (with *Pomadasys kaakan* and *P. maculatus*), Lobotidae (with *Lobotes surinamensis*), Priacanthidae (with *Priacanthus hamrur*), Pristigasteridae (*Opisthopterus tardoore*), Sparidae (*Acanthopagrus berda*) and Trichiuridae (with *Trichiurus lepturus*). For both fish families, the Lutjanidae and Siganidae, that were earlier represented only by unidentified *Lutjanus* spp. and *Siganus* sp. as monogenean hosts, a total of six different *Lutjanus* and two different *Siganus* species are now known as monogenean hosts,

respectively (App. I.1). Similarly, the mullid *Parupeneus spilurus* is the first identified host species in that genus. Additionally, *Alectis indica*, *Caranx heberi*, *Decapterus macrosoma*, *Gnathanodon speciosus*, *Scomberoides tol*, *Trachinotus blochii* (Carangidae), *Nematalosa come* (Clupeidae), *Acentrogobius nebulosus* (Gobiidae), *Scolopsis ciliata* (Nemipteridae), *Auxis thazard* (Scombridae) and *Cephalopholis igarashiensis* (Serranidae) represent new locality records from Indonesia. The formerly known 68 host species of 25 families herewith increase to **97** species from **32** families (Fig. 4). In addition, three monogenean taxa are herewith reported from the latid *Psammoperca waigiensis* from aquaculture (see Kleinertz & Palm in prep., available in Kleinertz 2017).

Five further families (Calceostomatidae, Gastrocotylidae, Gyrodactylidae, Plectanocotylidae and Tetraonchidae) and eight species (*Acanthoplacatus* cf. *sigani*, *Amphipolycotyle chloroscombrus*, Calceostomatidae indet. (counted as `species´ because it represents the only taxa of this family), *Encotyllabe* sp., *Heterapta* sp. (one of the two largest Monogenea from the present study together with Polyopisthocotylea indet. from *Pampus argenteus*), *Hexostoma keokeo*, *Octoplectanocotyla trichiuri* and Tetraonchidae indet. (counted as `species´ because it represents the only taxa of this family)), increase the total number of Monogenea in Indonesia to **21** families and **82** species. The real species number will be much higher, accounting that monogeneans are highly host specific. Consequently, the monogenean taxa from the fish families Pristigasteridae (Mazocraeidea indet. spp.), Ariommatidae (*Choricotyle* sp.), Ephippidae (Capsalidae indet.), Haemulidae (Dacytlogyridae indet.), Lutjanidae (Capsalidae indet., see remark[27]), Priacanthidae (Diplectanidae indet.), Sciaenidae (Monopisthocotylea indet. with `tentacles´ on haptor), Sparidae (Polyopisthocotylea indet.), Stromateidae (Polyopisthocotylea indet.) and from Cynoglossidae (Monogenea indet.) might represent 11 additional species, especially because no related taxa have been recorded so far infecting these hosts in the region. A total of 246 monogenean host-parasite records are known from Indonesia, 59 of them being new (App. I.1). This calculates for 0.7 monogenean families per infected fish family and a calculated 0.9 monogenean species per infected fish species (App. I.1, Figs. 4 & 5).

The fish families Carangidae, Serranidae and Scombridae are regular hosts for the Monogenea, frequently investigated due to their high commercial value (App. I.1). Nemipteridae is also a noteworthy host family, probably due to their feeding behaviour, filtrating mud and sand with monogenean eggs and larvae through their gills (compare infection patterns of the species described by the author (Theisen et al. 2017, 2018, Chapters 3-4)).

Even though monogeneans are known as highly host specific and lack intermediate hosts, *Pricea multae* (Thoracocotylidae) matures on Spanish mackerels (*Scomberomorus* spp.), but various small pelagic fishes (belonging to at least eight orders), which are preyed upon by these mackerels, are also infected with immature *P. multae* (Hayward 2005, Rohde 2005, Whittington 2005). In Indonesia, only *S. commerson* and *S. lineolatus* are so far known as hosts (see App. I.1).

Members of the `*Diplectanotrema*-group´ are also less host specific (Theisen et al. 2017, 2018), and sighting of material from Theisen (2009) discovered that a taxon previously identified as

Microcotyloidea indet. from *Johnius borneensis* also represents *Pseudempleurosoma haywardi* (see App. I.2, remark[26]), increasing the number of host species for this parasite to six. Interestingly, no further synodontid fish species besides the type host could be investigated for *Paradiplectanotrema klimpeli* so far (nine *Saurida* spp. occur in the region), and exploration of its hosts specificity is herewith encouraged. Asnita (2011) reported a *Pseudempleurosoma* sp. from a gobiid (App. I.1) living in symbiosis with a shrimp. This likely is a new parasite species, with a new host family, genus and species, and further analyses are herewith suggested. The fish can probably be caught easily with a small landing net while snorkelling/diving, e.g. around Nusa Karamba, Pulau Seribu, where the author has seen this fish/shrimp symbiosis already.

Cestoda

With further 11 fish families newly recorded as Cestoda hosts in Indonesia, namely Exocoetidae, Gobiidae, Labridae, Latidae, Lethrinidae, Lutjanidae, Malacanthidae, Polynemidae, Pomacentridae, Pristigateridae and Terapontidae, their number increases to **56** families. 31 host fish species for cestodes are herewith newly recorded, increasing their number from 88 to **119** fish species (Fig. 4). The host-parasite checklist for Indonesian mariculture (Kleinertz & Palm in prep., available in Kleinertz 2017) is herewith expanded with the record of a `tetraphyllidean´ from aquacultured *Psammoperca waigiensis* (First Educational Workshop on Marine Fish Parasites in Indonesia, Bali, 2013).

The numbers of cestode families (11) and species (48) are herewith increased to **12** and **53**, with newly recorded Polypocephalidae indet., *Nybelinia pseudafricana* sp. nov. (see this page below), *Parachristianella monomegacantha*, *Polypocephalus* sp., *Proemotobothrium southwelli* and *Rhinebothrium* sp. (App. I.1). 421 host-cestode records are now presented, with 80 new records (App. I.1). 0.2 cestode families occur per infected fish family, and almost 0.5 parasite species per infected fish species (Figs. 4 & 5).

Fish species infected with a diverse cestode fauna are usually large and predatory, act as paratenic hosts and are related to environments with many elasmobranchs (reefs or deep, open water). Noteworthy local hosts are *Coryphaena hippurus*, *Gempylus serpens*, *Taractichthys steindachneri* and *Trichiurus lepturus* with seven up to 11 different cestode species each, and various mullids, nemipterids and serranids can be infected by a range of cestode species (see App. I.1) (cf. Jakob & Palm 2006). They can also serve as accidental host if they are too large to be preyed upon by sharks. Theisen (2009) mentioned that the ecology and habitat of a fish, especially in open waters with direct contact to pelagic sharks results in a diverse cestode composition.

Besides Rhinoptericolidae sp. nov. isolated from a croaker by Theisen (2009, see introduction), a single specimen of *Nybelinia* sp. nov. from the Bigeye scad with similarities to *N. africana* is herewith newly recorded, yet undescribed. Even though 105 additional croakers (35 of three species each) were sampled for the present study, this new rhinoptericolid cestode species could not be recorded again.

In summary, for the Platyhelminthes from wild marine Indonesian teleosts, the number of 114 already known trematode species increases to **147**, 74 monogenean species to **82**, 48 cestode species to **53**, and 236 platyhelminth species (respective different lower taxa) to **282** in total.

1.4.3 Nematoda - with Focus on the Identity and Impact of *Anisakis*, *Hysterothylacium* and *Philometra* Species

One cystidicolid nematode species, *Mastigospirura cubicipitis*, was originally described from an Indonesian nomeid fish of the genus *Cubiceps* (Machida & Syahailatua 1994). Its photo in Machida & Syahailatua (1994) rather shows a camallanid, and the worm is herewith declared a *nomen dubium* (see remark[35] in App. I.2). Burhanuddin & Djamali (1983) recorded Anisakidae indet. from various Indonesian fish, and they are suggested to rather represent *Anisakis*, *Hysterothylacium* (now Raphidascarididae, used to be Anisakidae), and probably *Terranova* spp., as they are the most common and predominant `anisakids´ in Indonesia (see App. I.1 & I.2, remarks[30-31]). According to Chapter 2 (Palm & Theisen et al. 2017) and remarks[30-31], *Anisakis simplex* does not occur in the region and is a misidentification of the locally present anisakid species (and of a camallanid). Similarly, worms named *Anisakis* sp. are herewith suggested to represent one of the six locally known genotypes (see Chapter 2, Palm & Theisen et al. 2017 for details).

According to App. I.2, remark[28], *Contracaecum* sp., invalid *Porrocaecum* sp., *Hysterothylacium aduncum* and *H. fortalaezae* were corrected to *Hysterothylacium* sp. in those cases where species most probably not occurring in Indonesia might have been misidentified, and other worms named *Hysterothylacium* sp. are herewith suggested to represent *H. carangis* (for carangid hosts), *H. scomberoidei* (for *Scomberoides* spp. as hosts), *H. epinepheli* (for *Epinephelus* spp. hosts) and *H. gibsoni* (for *Saurida* sp. as host), strictly regarding to the host specificity of these nematodes. Molecular data from the region are still missing but are required in order to confirm this tentative identification. According to the remarks[29,32-43], *Philometra* sp. from *Abalistes stellaris* is suggested to represent *P. balistii* (host specific); *Camallanus* sp. from *Priacanthus tayenus* was inspected and corrected to *C. priacanthi* (especially due to host specificity); *Camallanus spinosus* (*nomen dubium*) from the trichiurid *Lepturacanthus savala* is suggested to represent *Camallanus trichiuris* (as known from other trichiurids in the region) and *Camallanus* sp. from the carangid fish *Megalaspis cordyla* was inspected and suggested to represent *C. carangis*; *Cucullanus* sp. from *Lutjanus vitta* was inspected and suggested to represent *C. lutjani* (also due to host specificity); *Capillaria* sp. from *Selar crumenophthalmus* was inspected and corrected to *Pseudocapillaria* (*Pseudocapillaria*) *carangi* (also due to host specificity); *Philometra lateolabracis*, probably not occurring in the region (cf. Moravec et al. 2012), from Carangidae was inspected and corrected to *Philometra* sp. and to *Philometra nemipteri* from nemipterid host fishes; the record of *Gnathostoma* sp. might represent a misidentification for Indonesian marine fish, and is herewith suggested to represent the morphologically and phylogenetically closely related *Echinocephalus* sp., which was already recorded from various marine Indonesian fish, e.g. by the author;

Mastigospirura cubicipitis is herewith declared a *nomen dubium*. The figures in the reference - an original species description from Indonesia - seem to rather show a camallanid (see above). *Philometra* sp. from priacanthids is suggested to represent *P. priacanthi* (host specific); *Philometra* sp. from sciaenids probably represents *P. sciaenae* (host specific); *Philometra* sp. from psettodids is suggested to represent *P. psettoditis* (host specific), as recorded by earlier authors for these hosts in the region; *Spirophilometra* sp. from fins of trichiurids probably represents *Philometroides trichiuri* (host and site specific), as recorded by other authors for these hosts and sites in the region; *Philometroides* sp. from the fins of serranids is suggested to represent *Spirophilometra endangae* (host and site specific), as recorded by earlier authors for these hosts and sites in the region; *Procamallanus* sp. from platycephalids probably represents *Procamallanus* cf. (*Spirocamallanus*) *platycephali*, as reported for this host in the region by the author; *Raphidascaris* sp. from nemipterids is suggested to represent *Raphidascaris* cf. (*Ichthyascaris*) *nemipteri*, as reported for these hosts within the present study (see discussion below); and *Raphidascaris* sp. from trichiurids is suggested to represent *Raphidascaris* (*Ichthyascaris*) *trichiuri* (host specific).

The Cynoglossidae, Ephippidae, Polynemidae and Sparidae are newly recorded as nematode hosts locally, increasing the number of fish families as hosts to **44**. 29 host fish species are herewith newly recorded, increasing their number to **136** (Fig. 4).

The species number (39 from already published data, counted after considering remarks (App. I.2) in the introduction above already) herewith increases to **48** (n = **11** families remains) (Fig. 4) with newly recorded *Camallanus atropusi*, *C. trichiuris*, *Cucullanus epinepheli*, *C. sciaenai*, *Dichelyne* (*Cucullanellus*) sp., *Iheringascaris inquies*, *Prospinitectus* cf. *mollis*, *Raphidascaris* cf. (*Ichthyascaris*) *lutjani* and *Spirocamallanus* sp. *Camallanus priacanthi* and *Philometra priacanthi* are recorded for the first time from Indonesia, because reports of *Camallanus* sp. from *Priacanthus tayenus* are suggested to represent *C. priacanthi*; and *Philometra* sp. from priacanthids is suggested to represent *P. priacanthi* (see introduction above, App. I.1 & I.2, with remarks[32,36]). The same accounts for *Cucullanus lutjani*, *Philometra* cf. *sciaenae*, *Procamallanus* cf. (*Spirocamallanus*) *platycephali* and *Raphidascaris* cf. (*Ichthyascaris*) *nemipteri* (see introduction & App. I.1 & I.2, with remarks[29,32,37,41-42]). An illustrated key to the most important nematode genera from the region is provided in Fig. 3.

717 host-parasite records for marine nematodes of wild Indonesian teleosts are known, with 131 of them new (App. I.1); 0.3 nematode families occur per infected fish family, and 0.4 parasite species per infected fish species (Figs. 4 & 5). These findings are not surprising, because the most abundant fish parasitic nematodes in Indonesia are anisakids and raphidascaridids (App. I.1), both families with relaxed host specificity in the teleost (intermediate) hosts. *Anisakis* spp. has been recorded for a broad range of teleosts (compare Palm & Theisen et al. 2017). Additional new hosts, *Cephalopholis igarashiensis*, *C. sexmaculata*, *Saurida tumbil*, *Variola albimarginata* and *V. louti* are herewith reported (from unpublished raw data of samples collected by Hendrik Stolz and the author in 2016), increasing the number of teleost species with *Anisakis* in Indonesia from 53 to 58. For *Hysterothylacium* spp.,

herewith 45 Indonesian teleost species are presented as hosts (App. I.1). *Hysterothylacium arii*, *H. carangis*, *H. scomberoidei* (App. I.1), and according to the remark[28] (App. I.2), *H. epinepheli* (for *Epinephelus* spp. hosts) and *H. gibsoni* (for *Saurida* sp.) are suggested to occur in Indonesian waters, awaiting molecular confirmation (while *H. aduncum* and *H. fortalaezae* are suggested to be misidentifications for Indonesia, compare App I.1 & remark[28], App. I.2). Recent first morphological and genetical analyses by the author suggest that even more species occur in Indonesia, with even a single respective species having a variation of characteristic morphological characters, especially of the tail during larval development (Fig. 2, cf. Torres et al. 1998).

Philometridae are known to be host specific to their teleost (final) host, and Dewi & Palm (2017) declared, that `A total of 20 different marine teleost hosts and 14 philometrid species have been identified from Indonesia. Nine serranids and two tetraodontids were found to be infected, followed by a range of other fish families´. App. I.1 demonstrates that 39 species of beloni-, perci-, pleuronecti- and tetraodontiform Indonesian fish are infected with philometrids, with gobiids and sparids herewith recorded for the first time. Even though the record of *Philometra sanguinea* (Desrina 2007) might require confirmation, 16 species are suggested to occur in Indonesian waters, now including *Philometra* cf. *priacanthi* and *P.* cf. *sciaenae*. For the effect of gonad infections with such philometrids, see the author's recent book chapter on fish phenotype change induced by parasites (Palm et al. 2018).

While all Indonesian fishes can be hosts for e.g. raphidascaridids and anisakids (e.g. Palm & Theisen et al. 2017), bottom dwelling, mud and sand filtrating nemipterids and sciaenids and well sampled, often reef-associated serranids as well as coral reef-associated tetraodontids are most important hosts for Indonesian philometrids (App. I.1).

1.4.4 Acanthocephala and Hirudinea

Acanthocephala

With documentation of two new fish host orders, Beloni- and Clupeiformes, with the herewith newly presented fish host families Belonidae, Clupeidae, Labridae, Lutjanidae, Rachycentridae, Siganidae and Terapontidae, and 16 newly recorded species (App. I.1), the number of acanthocephalan fish hosts increases to **27** (formerly 20) families and **52** (formerly 36) species. Known Acanthocephala taxa increase from 16 to **25** species (n = **8** families remains without a new family record (Fig. 4)).

The taxa presented and counted in the introduction considered remarks[44&46], omitting *Acanthocephalus lucii* and *Echinorhynchus gadi* (as synonym *E. socialis*). The former has been recorded from marine environments, but is suggested to be a misidentification for Indonesia, and rather represent Echinorhynchidae indet., while the latter is restricted to cooler waters in the Northern hemisphere, thus is also suggested as a misidentification, and rather represents another species of *Echinorhynchus*.

According to App. I.2, remarks[45,47&48], *Anisakis* spp. from *Abalistes stellaris* are Acanthocephala according to the figures in Zarry et al. (2017), and might represent Rhadinorhynchidae indet. (remains unidentified and is not counted as a species), or probably *Rhadinorhynchus laterospinosus*, as recorded

for the same host in adjacent Vietnamese waters by Amin et al. (2011b). Acanthocephala indet. from *Selar crumenophthalmus* was sampled and further identified to *Gorgorhynchus medius* (counted as species thus, according to host and zoogeography, compare Parukhin 1976 and Amin & Ha 2011); and *Rhadinorhynchus* sp. from *Thunnus* spp. is suggested to represent *R. zhukovi* or *R. johnstoni*, according to the host specificity and zoogeography (these two species are known to parasitise bonitos in South East Asia, however, they were not counted as an own species for Indonesia due to insecure identification).

0.3 acanthocephalan families occur per infected fish family, and 0.5 species per infected fish species (Figs. 4 & 5). 115 parasite-host records are known, with 31 from the present study (App. I.1).

Serranidae and especially Nemipteridae are parasitised by acanthocephalans in marine Indonesian waters, most probably due to their feeding ecology. Benthic amphipods that serve as intermediate hosts are preyed upon either directly or secondarily while preying upon small benthic fishes that serve as additional host. However, the high number of host records for these fish families results from a relative high number of fish species of these families being studied (see App. I.1). Other strictly benthic, omnivorous fishes, e.g. *Platycephalus* cf. *endrachtensis*, harbour many acanthocephalan taxa even though only studied during one sample of 20 fish specimens by Theisen (2009). On the other hand, even though being strictly benthic, species of the genus *Cynoglossus* are characterised by a small mouth, and are probably specific to certain prey items that do not transmit many acanthocephalan taxa (cf. App. I.1). Amin described various acanthocephalans from marine Vietnamese fish and provided keys to the genera (e.g. Amin & Nahhas 1994, Amin & Sey 1996, Amin & Ha 2011, Amin et al. 2011a, b). Therefore, identification of the here listed Indonesian parasites is suggested according to the host specificity, in part without further morphological comparison when impossible.

Hirudinea

With new records of the fish families (and species) Carangidae (*Atule mate*), Haemulidae (*Plectorhinchus schotaf*) and Sparidae (*Acanthopagrus berda*), the number of host families increases to **eight**, and their species number to **ten** (App. I.1). No new Hirudinea taxa for marine, free-living Indonesian fishes can be reported from the present studies (n = **1** species and family remains, from 18 records).

According to the rare documentation of Hirudinea from wild Indonesian marine fish (App. I.1), they play no major role in Indonesian waters. They are either preyed upon by cleaning organisms in reef habitats, or not common at all, and probably leave the fish host immediately after capture, are related to brackish or freshwater estuary environments, and are thus only relevant for mariculture studies in Indonesia (see Govedich et al. (2005), compare parasite checklist for Indonesian mariculture by Kleinertz & Palm (in prep., available in Kleinertz 2017)). However, as introduced above, they rarely cause issues on fish farms (Paladini et al. 2017).

1.4.5 Crustacea - with Focus on the Copepoda and Isopoda

Copepoda

The copepod hosting teleost families Centrolophidae, Chirocentridae, Latidae, Menidae and Sparidae, and 47 host species (including these of already documented families) are herewith newly recorded for Indonesia, increasing the number of fish families and species to **57** and **164**, respectively (Fig. 4).

Even though the copepod *Anuretes branchialis* has been recorded from *Platax teira* (Ephippidae) locally, *Anuretes* sp. from the same host rather represents a second species of the genus, suggested to be *A. plataxi* (App. I.1 & I.2, remark[55]), representing a new locality record. A new, yet undescribed lernaeopodid copepod was documented in Theisen (2009) from the sciaenid fish *Johnius coitor*. *Nibea soldado* and *Otolithes ruber* (also Sciaenidae) are herewith reported as additional host for this yet undescribed species from Indonesia. Stolz (2017) reported two new, undescribed *Lernanthropus* spp. from the serranid groupers *Cephalopholis miniata* and *Epinephelus quoyanus*. Consequently, at least three undescribed copepods new to science are included in the list in App. I.1.

According to App. 1.2, remarks[53-55], *Hatschekia* sp. from *Epinephelus* spp. was identified as *Hatschekia fuscoguttatus*. *Nothobomolochus* sp. from *Trichiurus lepturus* is suggested to represent *Nothobomolochus trichiuri* (host specific) and *Acanthochondria* sp. from *Psettodes erumei* is suggested to represent *Chondracanthus psetti* (host specific) (*A. psetti* is a synonym). These three copepods represent new locality records from Indonesia. Host specific *Pumiliopsis plautus* and *Colobomatus orientalis* (both representing new locality records for Indonesia), the latter from the lateral line channel of sciaenids, have interesting morphologies and are illustrated in Fig. 6. Of 72 known *Colobomatus* species (Walter & Boxshall 2018), only two, namely *C. sciaenae* described from Mediterranean *Sciaena umbra* by Richiardi (1876), and *C. orientalis* described from South Korean *Johnius grypotus* (Kim & Moon 2013), utilise Sciaenidae fish as hosts (Paschoal et al. 2016) (Fig. 6).

Recorded copepod taxa herewith increase from 131 to 150 species (without any new family record, n = **14** remains, Fig. 4). However, due to their high level of host specificity, records of *Nothobomolochus* sp. from the teleost host family Ariommatidae, *Caligus* sp. from Chirocentridae, Lernaeopodidae indet. from Centrolophidae, *Hatschekia* sp. from Gempylidae, *Caligus* sp. from Gerreidae, Bomolochidae indet. from Gobiidae, *Caligus* sp. from Haemulidae, bomolochids from Mugilidae, ergasilids and pennellids from Scatophagidae, caligids, ergasilids and lernanthropids from Sparidae, bomolochids from Stromateidae, bomolochids, caligids, ergasilids and lernaeopodids from Terapontidae and also hatschekiids and chondracanthids from Tetraodontidae, might represent additional 20 distinct species, because no congeners (nor taxa from the same parasite families) have been recorded so far from the respective host families. The total number of Indonesian marine copepod species parasitic on teleosts is therefore considered **170** (App. I.1 & I.2, Fig. 4).

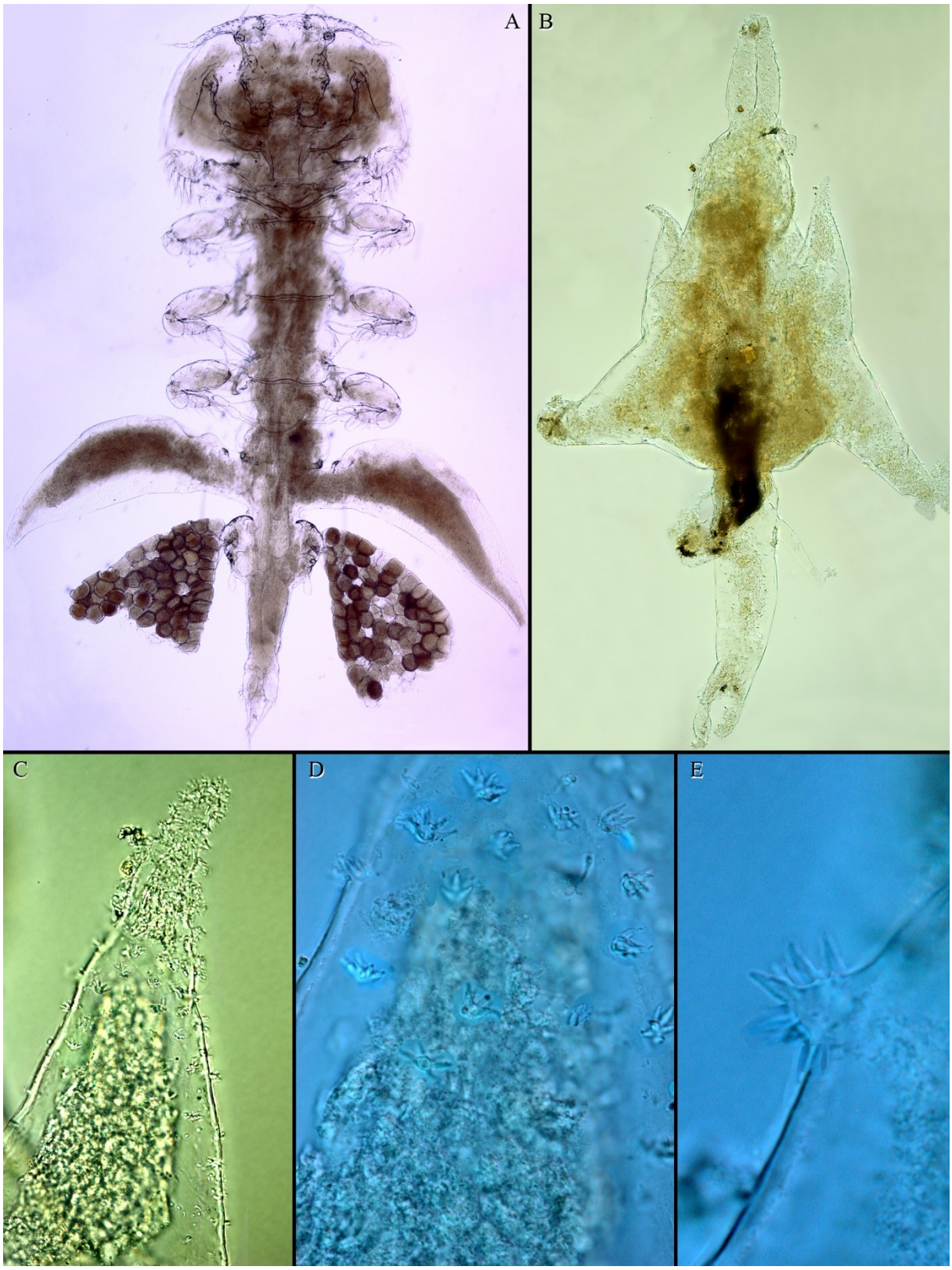

Fig. 6 Morphology of interesting copepods from marine Indonesian Actinopterygii: A: *Pumiliopsis plautus*, a gill parasite of *Amblygaster sirm*, B: *Colobomatus orientalis* from *Nibea soldado*, with detailed surface spines for attachment in the cephalic sensory system (lateral line channel) (C-E).

In average, there is one copepod species per infected fish species and 0.25 copepod families per infected fish family (Figs. 4 & 5).

511 parasite-host records for parasitic copepods have been reported from Indonesia (including the below stated species records without any host), including 129 new records from the present study (App. I.1). Most records are known from the fish families Carangidae and Serranidae, because they are the most intensively investigated fish families due to their commercial importance and regular availability on Indonesian fish markets.

Five parasitic copepod species have been recorded without a given host from Indonesian waters (App. I.1): *Bomolochus efficatus*, originally described from Indonesian waters in 1934, is a *species inquirendum* (cf. Ho & Lin 2009). *Caligus coryphaenae* is known to parasitise the dolphin fish *Coryphaena hippurus* and various scombrids, also from the Neotropical region, Mediterranean and Eastern Central Atlantic (Carbonell et al. 1999, Morales-Serna et al. 2016). *Ceratochondria brevicollis*, originally described from Indonesian waters in 1863, is known to parasitise the flatfish *Pseudorhombus arsius* in Taiwanese waters (Ho et al. 2011). *Ergasilus borneoensis* is a parasite of groupers in South East Asia, e.g. Malaysia (Leong & Wong 1988, Woo et al. 2002). *Euryphorus brachypterus* is a parasite of wild Pacific Bluefin tuna *Thunnus orientalis*, e.g. in Japan (Kanaiwa et al. 2016). All these fishes occur in Indonesia and are most likely to represent the local hosts.

Isopoda

The five fish families Cynoglossidae, Haemulidae, Priacanthidae, Rachycentridae and Sciaenidae, including 21 teleost species, are herewith for the first time recorded as hosts of Indonesian marine Isopoda (App. I.1). This increases the number of Actinopterygii known to host marine Indonesian isopods from 36 to **41** families and from 67 to **88** species (Fig. 4).

With no newly recorded fish parasitic isopod family or species, the number of isopod families remains **three** with **78** species (Fig. 4). In average, there are 0.9 isopod species per infected fish species and less than 0.1 isopod families per infected fish family (Figs. 4 & 5).

Many isopods are known to have a low host specificity, e.g. *Rocinela signata* infecting both, actinopterygiid and even elasmobranch fishes in the Caribbean (Bunkley-Williams et al. 2006). 155 species of fish parasitic Aegidae are known, of which 33 are recorded from adjacent Australian waters (Martin 2015). Australian corallanids consist of 15 species from five genera, from a total of 80 species belonging to six genera worldwide (Martin 2015). According to Smit et al. (2014), the Cymothoidae consist of 383 species belonging to 40 genera, mostly with high host and site specificity, of which 71 species and 17 genera are found in adjacent Australian waters (Martin 2015). Bruce (1986, 1987a, b, c, 1990, 1991) reviewed the external surface attaching (*Anilocra, Creniola, Nerocila, Norileca, Pleopodias* and *Renocila*) and gill attaching isopod genera (*Elthusa*, *Livoneca* and *Mothocya*) from Australia and provided keys for their identification (Martin 2015). *Ceratothoa*, *Cymothoa*, *Glossobius* and *Smenispa* attach to the mouth (~ buccal) cavities of their hosts (Martin 2015). As stated by Martin (2015),

comprehensive genus diagnoses are available for *Cymothoa* (Hadfield et al. 2013), *Ceratothoa* (Hadfield et al. 2014), *Glossobius* (Bruce & Bowman 1989) and *Smenispa* (*Enispa* in Bruce 1990).

In Indonesia, 378 parasite-host records for isopods have been reported so far (139 of them without any host association), 29 of them from the present study (App. I.1). 68 host records are known for gnathiid praniza larvae (App. I.1), 22 from the present study. The Gnathiidae are cosmopolitan with 222 species belonging to 12 genera, of which 56 species from seven genera occur in adjacent Australia (Martin 2015).

Most host records are given for the fish families Carangidae and especially for the Serranidae, because they are the most intensively investigated fish families due to their commercial importance and regular availability on Indonesian fish markets. The high number of records without any host association is either explained because the respective species are only temporary parasites and have been collected as a free-living form. Because most of these isopods are comparably large, visible by naked eye and disgusting consumers on the fish markets, they are therefore often collected off the host fishes by fisher- and salesmen, and subsequently thrown onto the floor of the fish market. During fish samplings for parasitological investigations on the fish markets, such isopods were also sampled, however, without clear host affiliation.

Omitting taxa considered as *nomen dubium* or *taxon inquirendum* (cf. App. I.1 and remarks in App. I.2), 47 species were recorded from Indonesian waters without host affiliation (App. I.1). Of these, in adjacent Australia, *Ceratothoa imbricata* is known from the hosts *Trachurus declivis* and *T. novaezelandiae*, *Cymothoa indica* from various aulopi-, beloni-, clupei-, perci- and siluriform fishes, and *Cymothoa pulchrum* from various Tetraodontiformes (cf. Martin 2015). *Anilocra capensis* utilises the sparid *Pterogymnus laniarius* off South Africa, *A. cavicauda* is known from *Scolopsis bilineatus*, *A. leptosoma* from *Nematalosa come* and *N. erebi*, and *A. longicauda* from *Plectorhynchus goldmani* and *Diagramma picta* (all in Australia, cf. Bruce 1987c). However, for the remaining taxa, no host identification is available, and some of the isopods most probably also parasitise elasmobranch fishes.

Lobothorax typus, originally described from Indonesia as the type locality but without a host (Bleeker 1857, also in Nierstrasz 1931, Schiødte & Meinert 1879-1884, Sidabalok 2013), is herewith for the first time recorded from its type locality with its regular host, *Trichiurus lepturus*. It was already earlier recorded from this host in Indonesia by Theisen (2009), but misidentified as *Cymothoa* cf. *truncata*.

Norileca indica, also originally described from Indonesia as the type locality and also without host association (Milne Edwards 1840, mentioned in Trilles 1979, Sidabalok 2013), is for the first time reported from its regular host, *Selar crumenophthalmus*, from its type locality. A new host record for this parasite is also presented with the close relative *Selar boops* (already published in Indonesian language by Wibisono 2012) (cf. Van der Wal et al. 2017, summarising all known hosts of this parasite).

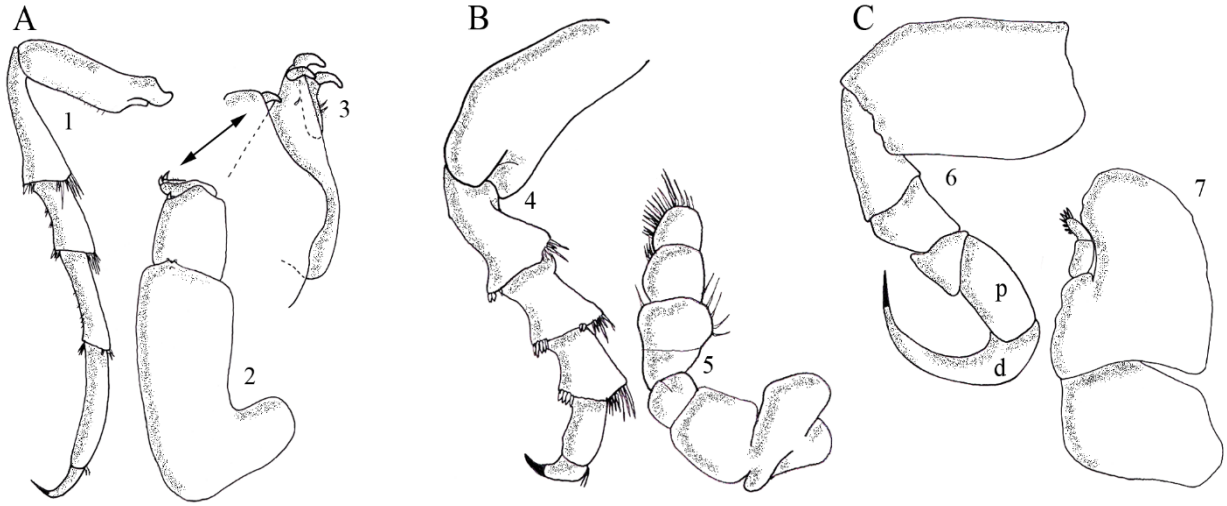

Fig. 7 Pereopods and maxillipeds of Indonesian fish parasitic Isopoda families: A: Aegidae: 1: Pereopod VII, 2: Maxilliped, 3: Maxilliped tip enlarged with detailed stout, recurved apical spines, B: Corallanidae: 4: Pereopod VII, 5: Maxilliped, C: Cymothoidae: 6: Pereopod VII, 7: Maxilliped; d: dactylus, p: propodus. Redrawn according to Bruce (2005) (A), Bruce (1982) (B) and Hadfield et al. (2011) (C).

In the following, a brief summary of the key characters of the isopod families from Indonesia is given, enabling a better identification and future collection of these parasites from Indonesian marine waters. Fish parasitic praniza larvae of gnathiid isopods are easily identified as such and therefore are not included in the key.

Key characteristics of local isopod families (according to Delaney (1989) and Bruce (2009), simplified):

Aegidae: Fig. 7 A: Less modified pereopods (~ seven pairs of walking/grabbing legs, see Fig. 7 A1) compared to Cymothoidae, e.g. pereopods IV-VII with dactylus (~ last segment of these legs, Fig. 7 A1) shorter than propodus (~ penultimate segment just before the dactylus, Fig. 7 A1), not markedly curved. Maxilliped (~ most posterioventral part of the mouth that covers the other mouthparts, Fig. 7 A2) with stout, recurved apical spines (Fig. 7 A2-3) (see Kensley & Schotte (1989) for an overview of general isopod morphology).

Barybrotidae: In contrast to other three families not on ray-finned fishes, but on Elasmobranchii.

Corallanidae: Fig. 7 B: Less modified pereopods compared to Cymothoidae, e.g. pereopods IV-VII with dactyli shorter than propodi, not markedly curved (Fig. 7 B4) (similar to Aegidae above), with - in contrast to aegids - maxilliped without stout, recurved apical spines (Fig. 7 B5).

Cymothoidae: Fig. 7 C: Pereopods more modified compared to Aegidae and Corallanidae, e.g. pereopods IV-VII with dactyli longer than propodi, markedly curved (Fig. 7 C6). Maxilliped without stout, recurved apical spines (Fig. 7 C7).

1.4.6 Parasite Records and Checklists

This thesis summarises the current state of knowledge on fish parasites from Indonesian marine waters, including the presentation of comprehensive host-parasite and parasite-host checklists. As can be seen in Figs. 8-9, most parasite records have been reported within the last 20 years, when the fish parasitological efforts in Indonesia have intensified. However, since the first species description of a marine fish parasite from Indonesia in 1840 (Milne Edwards 1840) species descriptions have regularly appeared in the international literature. In total, 3,005 host-parasite records (147 without exact host fish identification) of 621 parasite species from 315 free-living marine Indonesian teleost species belonging to 94 families and 18 orders are presented including the new data and listing 201 references. Local Indonesian bachelor and master theses are considered for the sake of completeness, but are sometimes rather inadequate (e.g. acanthocephalans identified as nematodes, or fish scales as parasites). One local thesis from Pruyitno (1999) on endoparasites of *Psettodes erumei* (Bleeker) was not available to the author.

According to the new checklist in App. I.1, the total number of parasite taxa from free-living marine Indonesian teleosts is now **621** species belonging to **111** families (17 microsporean, ciliophoran and myxozoan taxa (1+8+8) of 11 families, 147 trematode species from 30 families, 82 monogenean species from 21 families, 53 cestode species from 12 families, 11 nematode families with 48 species, 25 acanthocephalan species from eight families, one hirudinean species and family, 170 copepod species from 14 families, and three isopod families with 78 species, see App. I.1-2 & Fig. 4; the branchiuran *Argulus belones* is not considered because it is rather known from freshwater environments). About 12 years ago approx. 400 parasite species had reported locally (including aquaculture fish and elasmobranchs), which is less than 3.3% of the estimated species richness (see introduction) (cf. Jakob & Palm 2006, Neubert 2018). Herewith, the number is raised to 5.5% of the expected fauna from Indonesia, not considering the fewer than 100 species from the elasmobranchs.

The appendix of this dissertation includes this new checklist of marine fish parasites from Indonesia, based upon a compilation by Palm et al. (in prep.), that has been prepared over many years by different workers. For the presented list (App. I.1), the taxa are listed alphabetically as follows: I) fish order, II) fish family, III) fish species, and then further ordered alphabetically, with IV) higher parasite taxa (e.g. Acanthocephala, Cestoda, Crustacea, Digenea, Monogenea, Nematoda), then with V) parasite family and finally with VI) parasite species or identity to the lowest level. References are given additionally, their numbers per year are presented in Fig. 8; and most comprehensive studies with respect to parasite-host records are summarised in Fig. 9. Invalid synonyms in the references were corrected to the valid names according to the most recent literature. Cells with bold font indicate new entries by the author up to the year 2018. Original species descriptions with Indonesia as the type locality (summarised in Fig. 1) are marked in green. Highlighted numbers from [1] to [60] (blue colour) mark parasite taxa with more specific annotations (in App. I.2). These taxa were only identified to a higher taxonomic level in the re-

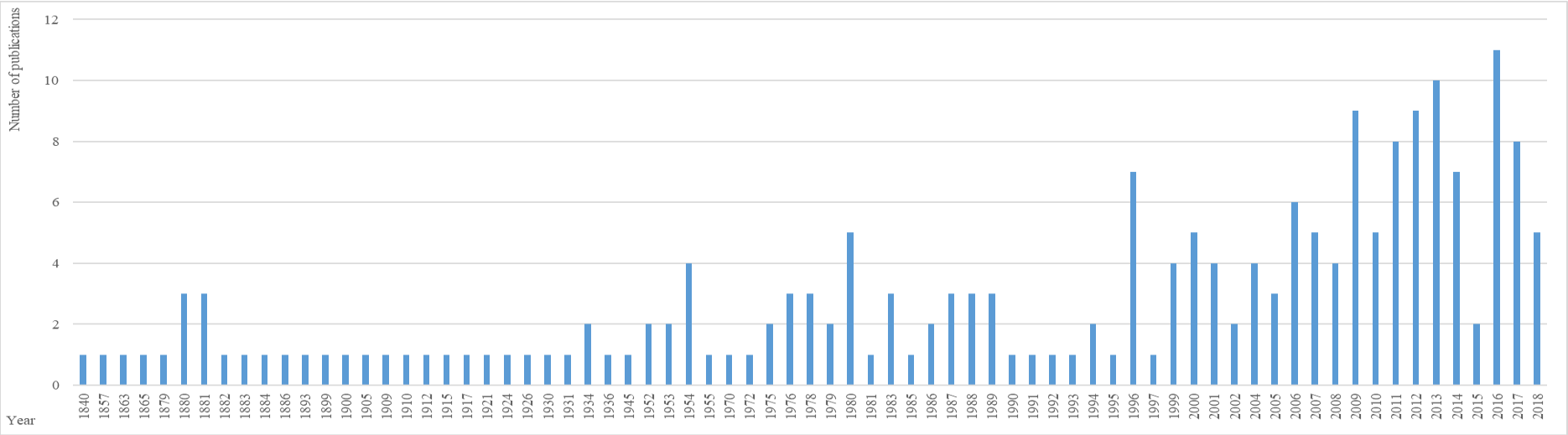

Fig. 8 Number of publications on parasites of Indonesian marine free-living Actinopterygii: Chronologically, per year since 1840, n = 201 in total.

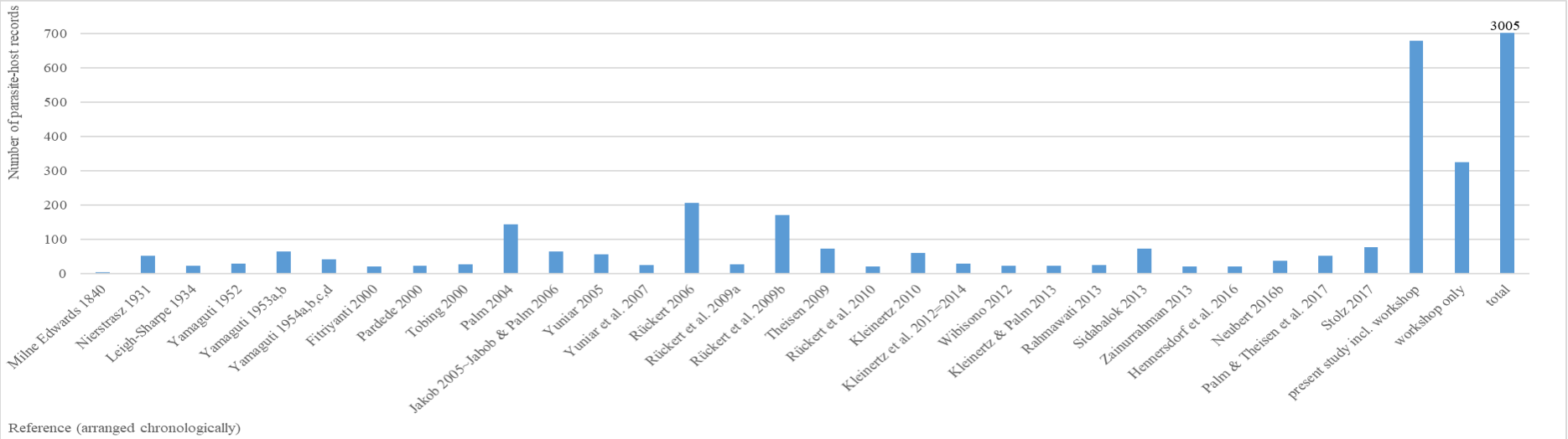

Fig. 9 Number of parasite-host records for Indonesian marine free-living Actinopterygii in most comprehensive publications (> 20 records except for the first reference from 1840 with a single species only): Chronologically since 1840 (early records and Sidabalok (2013) without hosts), with a total of 3,005 records, of them 678 from present study and of these 325 from the Bali workshop in 2013.

ferred reference (e.g. to family or genus level) and needed further identification and interpretation of the actual literature (see discussion above, Chapters 1.4, 1.4.1-1.4.5, and annotations to the checklist, App. I.2).

The electronic version of App. I.1, an excel spreadsheet, contains additional information and the possibility to sort all data, e.g. parasite families or species alphabetically without previous consideration of the host fish species (~ parasite-host list).

Based on Chapters 1.4, 1.4.1-1.4.10, 2-5 (cf. also all figures and tables), the checklist in App. I.1 and the annotations in App. I.2, it can be stated that the working **hypothesis 1** (*Indonesia encounters a high marine biodiversity. The current knowledge on fish parasites from Indonesia is scarce, and requires future attention*) and **hypothesis 2** (*New species descriptions, locality and host records can be made*) can be verified.

It is herewith concluded that fish orders that are virtually uninvestigated (according to App. I.1) regarding their parasites in Indonesia, e.g. Anguilliformes, Atheriniformes, Elopiformes, Gadiformes, Gonorynchiformes, Lophiiformes, Myctophiformes and Ophidiformes, represent promising future targets for investigations.

1.4.7 New Methods in Fish Parasite Taxonomy

Based on Chapter 2 (*Anisakis* (Nematoda: Ascaridoidea) from Indonesia) (Palm & Theisen et al. 2017), the DNA analyses of anisakid nematodes from Indonesia demonstrated the existence of different genotypes within the genus *Anisakis*, extending the number of *Anisakis* species from Indonesian host fishes to six. Even though the larvae of the different *Anisakis* species are morphologically very similar, the revision of all so far available sequences of 243 *Anisakis* specimens (ITS1-5.8S-ITS2 marker) from Indonesian *Anisakis* (of these 125 earlier sequences from GenBank) identified six different local genotypes (~ species). Three worms belonged to *Anisakis* sp. HC-2005 and 39 (16%) to *A. typica* (sensu stricto). The majority (193 worms ~ 79%) of infections had a distinct genotype, closely related to *A. typica* regularly reported from tropical waters throughout the world. Since 2008, these `*A. typica*´, `sibling´, `*Anisakis* sp./type 1´, `sp. I´, `sp. 2´ or `sp. II´ have been regularly reported from Indonesia. Palm & Theisen et al. (2017) applied the subspecific entity *Anisakis typica* var. *indonesiensis* until a description of the adults becomes available to avoid further misleading identification. This verifies **hypothesis 3** (*Newly applied methods and molecular analyses demonstrate an even higher species biodiversity of the so far (only morphologically) recorded parasites, with the recognition of different genotypes for specific morphotypes*).

Anisakis berlandi and *A. pegreffii* were reported for the first time from teleosts in the equatorial region and *A. physeteris* from the Pacific Ocean. This helped to classify the risk of an anisakiasis infection for human consumers in Indonesia as being low, because the infections of the fish muscle tissue (the consumed fillet) with *Anisakis* was scarce; and *A. pegreffii*, the only local species that is considered zoonotic, contributed to the total frequency of occurrence with 0.04% (one single worm).

This verifies working **hypothesis 4** (*Knowledge of the fish parasite species from Indonesian waters enables conclusions to be made on zoogeographical distribution patterns of fish parasites in the world´s oceans*).

It is herewith concluded that many more host fish species will be reported from Indonesia in future including further *Anisakis* genotypes. We established 16 new host records and reported 53 (this number was raised to 58 in Chapter 1.4.3 above) Indonesian teleost *Anisakis* hosts, and we increased the worldwide known teleost hosts with genetically identified *Anisakis* from 155 to 177 (see **hypotheses 1 & 2**). A new species of *Anisakis* will be described in future as soon as adults of *Anisakis typica* var. *indonesiensis* become available. Because of positive tests for *Anisakis* antibodies in Indonesian citizens (Uga et al. 1996) and our record of the human-pathogenic species *A. pegreffii*, seroepidemiological or stereoscopic tests of Indonesian citizens are proposed.

Based on Chapters 3 & 4 (two endoparasitic Monogenea species descriptions), confocal microscopic analyses of monogeneans of the `*Diplectanotrema*-group´, stained with Gomori's trichrome and mounted in Canada balsam, allow a detailed analysis of sclerotized structures, e.g. hooks from the opisthaptor or parts of the genital complex. This method has regularly been used for the description of these characteristics among other monogenean groups (e.g. Galli et al. 2006). For the first time in the Monogenea, two (new) endoparasitic species of the genera *Pseudempleurosoma* and *Paradiplectanotrema* from Indonesia were studied by using the confocal microscope. The hooklets and the male copulatory organ with its accessory piece were particularly easily seen, and new insights were brought into the structure of the dorsal and ventral bars and anchor complexes. It can be verified that such microscopic techniques newly applied to the study of endoparasitic monogeneans are useful methods, allowing the recognition of new species and morphotypes (see Chapter 3 and 4). Even though some original species descriptions of the `*Diplectanotrema*-group´ members lack precise information on morphology and measurements, confocal microscopy made it possible to position morphological structures, providing angle of views for illustrating and comparison as well as accurate measurements. This methodology is found to be suitable to detect minor, often difficult to describe differences in the haptoral structures of these small monogeneans, necessary for genus and species identification (**hypothesis 3**).

So far, only a few endoparasitic monogeneans have been recorded and described worldwide with limited zoogeographical distributions, e.g. most species of the `*Diplectanotrema*-group´ off western Africa (Gerasev et al. 1987, cf. Theisen et al. 2017, 2018). That is in part because standardised fish parasitological methods do not consider the oesophagus and pharynx tissue as microhabitats of monogeneans, where they are hidden in the epithelia folds under the mucus. A new methodical screening technique for endoparasitic monogeneans is herewith presented (Fig. 10). This increases the chance for their future records worldwide (confirming **hypothesis 3**).

Besides these new microscopic and screening techniques for endoparasitic monogeneans, the first DNA sequences (cf. **hypothesis 3**) for species of the two Monogenea genera *Pseudempleurosoma* and

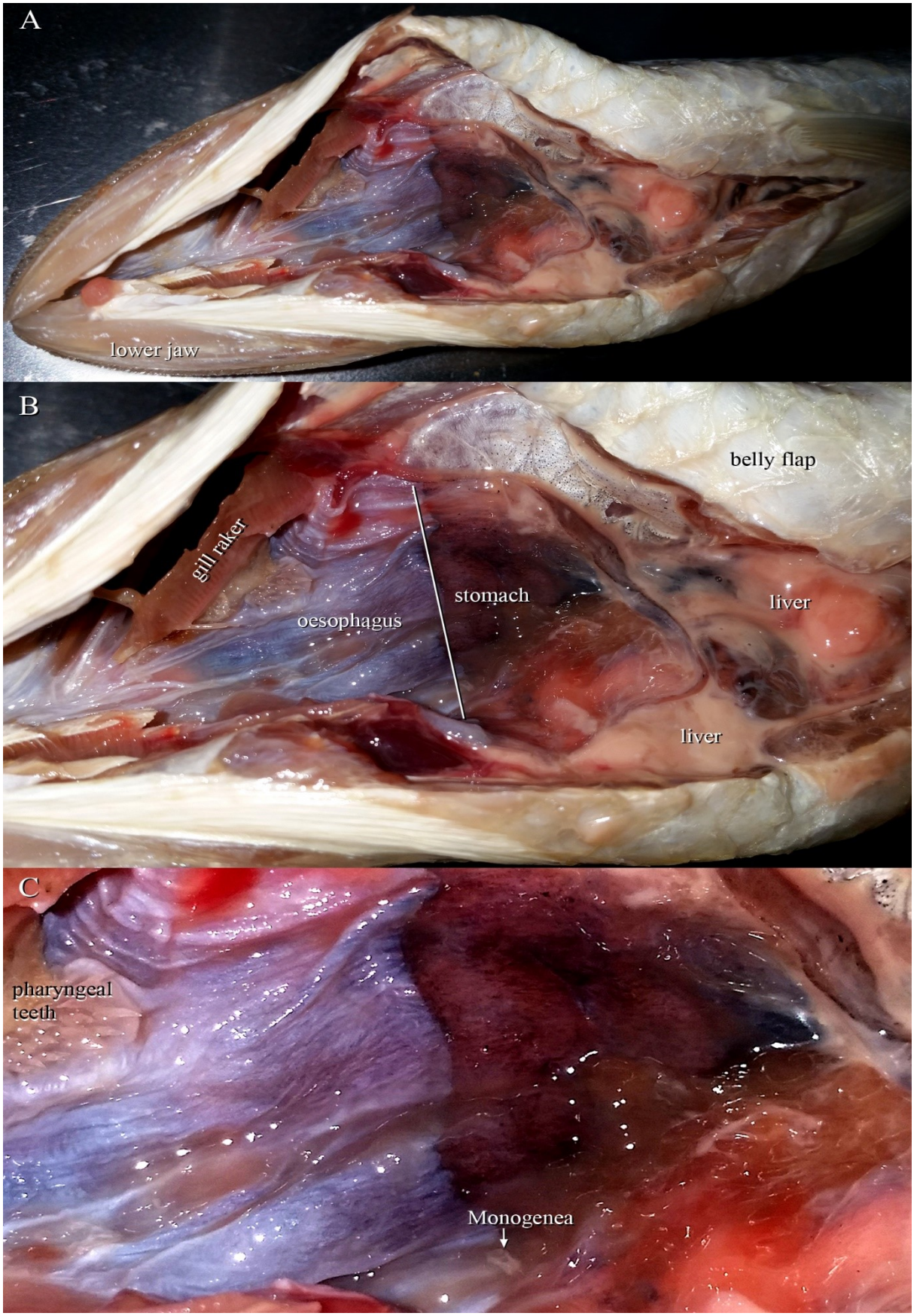

Fig. 10 New screening technique for endoparasitic Monogenea in fish: A: The lower jaw of the fish host was divided by one cut with scissors inserted into the mouth; the oesophagus was cut along from the ventral side and rinsed, B: Gills, delineation between the oesophagus and the stomach, and surrounding liver tissue is shown, C: An endoparasitic Monogenea at its typical site between the oesophagus and stomach.

Paradiplectanotrema demonstrate close relatedness with endoparasitic freshwater monogeneans from African cichlid fishes, suggesting a freshwater origin for these marine endoparasitic monogeneans, according to **hypothesis 4**. The new information on the zoogeographic distribution of these two genera, e.g. the first record of *Paradiplectanotrema* in the Pacific, further verify **hypothesis 4**. The *Diplectanotrema* group is ideally suited to investigate the spreading of a respective lifestyle and the worldwide colonization out of African waters into the world's oceans (**hypothesis 4**). Chapter 4 suggests that more endoparasitic Monogenea species occur in Indonesia (confirmation of **hypotheses 1, 2 & 4**), the zoogeography of the Indonesian species covers additional tropical areas and further phylogenetic analyses of other diplectanotreme genera will shed more light on their evolution (confirming **hypotheses 3 & 4**).

Based on Chapter 5 (the description of the bucephalid trematode *Bucephalus damriyasai*), the number of bucephalid trematodes known from Indonesian waters is now 13, two of them await further identification (which is more than a quarter of worldwide 48 described nominal species in marine fishes, cf. **hypotheses 1 & 2**). A visual key to the species, similar to that to *Prosorhynchus* developed by Bray & Palm (2009), was applied. Ten characters were used, most of which are listed as a percentage of body length: 1, length; 2, width %; 3, rhynchus length %; 4, tentacle number; 5, pre-vitelline distance %; 6, pre-uterine distance %; 7, pre-mouth distance %; 8, post-testicular distance %; 9, cirrus-sac reach %; and 10, egg length. `Cirrus-sac reach´ is the distance between the posterior extremity of the worm and the anteriormost extent of the cirrus-sac. These characters and the percentage values are found to be suitable to detect minor, often difficult to describe differences necessary for genus and species identification, further verifying **hypothesis 3**.

Based on the checklist presented in the App. I.1, it will be possible to focus on further digenean families or genera, summarise their species and hosts, recognise the relevant literature references and publish summaries as well as conclusions on their biodiversity in Indonesia, with respective identification keys (according to **hypotheses 1-4**).

1.4.8 Fish Parasites from Indonesia Compared to Other Regions

The current knowledge of marine Indonesian fish parasites remains insufficient. Fig. 5 demonstrates that the Digenea, Monogenea and Copepoda are represented by ca. one parasite species each per infected fish species. On the other hand, Cestoda, Nematoda and Acanthocephala are represented by only 0.2-0.3 parasite species each per infected fish species. This does not inevitably mean that the three former groups are host specific to a high degree, because, e.g. for the Digenea, 147 parasite species are distributed to 138 fish host species and in theory, each of the 147 Digenea species could parasitise each of the 138 fish species. On the other hand, the Cestoda, Nematoda and Acanthocephala are represented by species numbers that are lower than the species numbers of infected hosts. Consequently, they can be considered as less host specific in Indonesian marine waters. The calculated values for Isopoda should not be considered here because many species were collected and recorded without a host, see Chapter

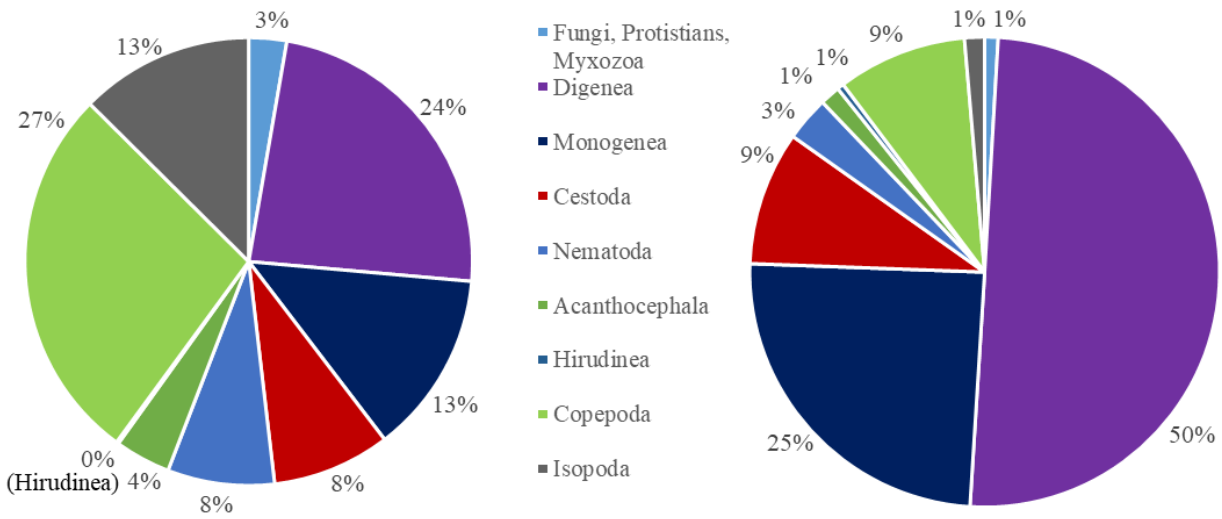

Fig. 11 Number of marine fish parasite species in Indonesia (left) and Hawaiian waters (right, from Palm & Bray 2014) in percentage (total numbers see text): It is evident that remote Hawaiian waters were colonised by hermaphroditic parasite groups (see discussion text below).

1.4.5. A detailed comparison with the parasite fauna of subtropical Hawaiian waters (cf. Palm & Bray 2014) is given (Fig. 11), with focus on the zoogeographical distribution, which is of special interest because the Hawaiian islands must have been reached and colonised individually by each parasite taxon while and after their fish hosts arrived at these remote islands, leading to a high number of endemic species (cf. Palm & Bray 2014).

According to Palm & Bray (2014), 652 species (six Myxozoa, 160 Monogenea, 60 Cestoda, one Aspidogastrea, 326 Digenea, 20 Nematoda, nine Acanthocephala, three Hirudinea and 67 Crustacea) are known from Hawaii. 20% of the locally occurring fish community has been studied for parasites, making the region one of the best known in these terms (Palm & Bray 2014). A comparison of the parasite composition with Indonesia shows that remote Hawaiian waters were colonised by hermaphroditic parasite groups. A single specimen, equipped with both, male and female genitalia, of the platyhelminths (Digenea, Monogenea and Cestoda) can reproduce, and thus invade remote, new ecosystems. Indonesian waters, on the other hand, represent an older ecosystem, with comparable high species numbers of dioecious (sexually dimorphic) fish parasite groups. They need at least two individuals, one male and one female, for reproduction. Especially ectoparasitic Crustacea, with the copepods being the most speciose group of metazoan ectoparasites of marine fishes, are very abundant (cf. Chapter 1.3.3.6), and also endoparasitic Nematoda and Acanthocephala are therefore speciose in Indonesia. Thus, fish parasites of Indonesian waters allow an explanation of the distribution of respective taxa in the world´s oceans (verification of **hypothesis 4**). However, the techniques used for the study of the Hawaiian fish parasite fauna have probably been more standardised than the techniques used in Indonesia, and therefore ratios of the parasite composition are not completely comparable (cf. Truong (2018) for a comparison between Hawaii and the Gulf of Tonkin, Vietnam).

Based on i) the demonstrated distribution of an endoparasitic lifestyle among Monogenea, originating from African freshwater species, and ii) the documented South-East Asian distribution of the digenetic genus *Qadriana*, and iii) the worldwide distribution of the zoonotic nematode genus *Anisakis*, with first documentations of respective species for these genera in Indonesia (cf. Chapters 1.4.2-1.4.3, 2-4, and Tabs. 1-2), herewith further insights into the zoogeography of selected parasite groups are provided (further confirmation of **hypothesis 4**).

1.4.9 Fish Parasites and Aquaculture

Neubert (2018) summarised the potential of parasites from groupers as biological indicators, especially in tropical aquaculture, mentioning the species *Epinephelus coioides* and *E. ongus* as promising targets for such studies. Stolz (2017) documented the macroscopic ectoparasite communities of these Indonesian serranid groupers. This present thesis now reports all so far known parasites of Indonesian free-living groupers, and delivers comprehensive data of serranid parasites together with the checklist for Indonesian maricultured fishes (Kleinertz & Palm in prep., available in Kleinertz 2017).

The checklist by Kleinertz & Palm (in prep., available in Kleinertz 2017) provided the first detailed information on Indonesian mariculture fish parasites, belonging to the ten phyla Mastigophora, Ciliophora, Microspora, Myxozoa, Cnidaria, Platyhelminthes, Nematoda, Acanthocephala, Annelida and Crustacea (19 classes, 30 orders, 43 families), parasitising 17 cultured ray-finned fish species belonging to the four orders Elopiformes, Gonorhynchiformes, Syngnathiformes and Perciformes with the nine families Megalopidae, Chanidae, Syngnathidae, Centropomidae, Labridae, Lutjanidae, Scatophagidae, Serranidae and Siganidae. This mariculture checklist is herewith extended, with additional records for the Sand perch *Psammoperca waigiensis*, investigated during the the First Educational Workshop on Marine Fish Parasites in Indonesia, and data for Brown-marbled grouper *Epinephelus fuscoguttatus*: *P. waigiensis* is parasitised by the myxosporeans *Ceratomyxa* sp. and *Kudoa* sp., ciliophoran *Trichodina* sp., aporocotylid and cryptogonimid digeneans, capsalid, dactylogyrid and diplectanid monogeneans, a `tetraphyllidean´ cestode and by the copepod *Lernanthropus latis*. 70 specimens of *E. fuscoguttatus* that were investigated by the author in Nusa Karamba Aquaculture, Pulau Seribu, 50 km off Jakarta, showed the same infection patterns as in former studies from this area (Kleinertz & Palm in prep., available in Kleinertz 2017). Most noteworthy, commercially important philometrid nematodes (cf. Chapters 1.3.3.3 & 1.4.3) were documented as in former years, representing the only philometrid records for Indonesian aquaculture so far. Using a comparison of the mariculture parasite diversity and the composition of parasites of free-living fish presented here, the risk potential can be further estimated (verification of **hypothesis 5**: *Most so far known fish parasite records originate from aquaculture or commercially exploited fish. A summary of the current state of knowledge in the form of a host-parasite checklist enables evaluation of the potential risk from fish parasites to the aquaculture and fisheries industry in Indonesian coastal waters*). While 17 cultured fish species are infected by 95 parasite taxa, 315 free-living fish species are hosts of 621 parasite species (or lower taxa

respectively). However, of the latter, most frequently recorded host species are commercially important (cf. Chapters 1.4.1-1.4.5), further verifying **hypothesis 5**. It is known that aquaculture conditions can support various parasite taxa, e.g. Copepoda and Monogenea with simple, direct life cycles (cf. Rückert et al. 2008, 2009b, 2010). Trash fish provided as food for cultured fish also bears the risk of the infection with endohelminths. Additionally, bacteria and trichodinid ciliates are known to prefer the resulting water conditions from dense fish aggregations in aquaculture facilities. However, the highest parasite diversity is usually present in fish from natural environments (cf. Rückert et al. 2008, 2009b, 2010).

18 additional marine parasite species are known from Indonesian mariculture exclusively, namely the prokinetoplastid protozoan *Ichthyobodo necator*, the dinoflagellates *Amyloodinium ocellatum* and *Oodinium* sp., the microsporean fungi *Glugea* sp., Ciliophora of the genera *Brooklynella*, *Uronema* and *Zoothamnium*, the cnidarian Bougainvilliidae indet., the monogeneans *Benedeniella* sp. (cf. *epinepheli* due to host specificity and a grouper as documented host), *Hexabothrium* sp., *Laticola latesi* and *Pseudorhabdosynochus coioidesis* (various unidentified *Pseudorhabdosynochus* spp. are known from similar, free-living hosts), the digeneans *Isorchis parvus* and an enenterid species, the cestode *Eubothrium* sp., the acanthocephalan *Corynosoma* sp., a hirudinean of the genus *Branchellion* and the copepod *Caligus patulus* (cf. Kleinertz & Palm in prep., available in Kleinertz 2017). *Aporocotyle* sp. from a cultured grouper is suggested to be equal to Aporocotylidae indet. known from a free-living grouper's heart (see App. I.1). Therefore, the total number of parasite species from Indonesian Actinopterygii, maricultured and free-living, is **639** (cf. **hypothesis 1 & 4**). It can be summarised that Mastigophora, Ciliophora, Microspora, Myxozoa, Monogenea and Copepoda play major roles as Indonesian mariculture parasites and pests (cf. **hypothesis 5**).

The comparison of both checklists for selected fish species shows that more parasite taxa have been recorded for aquacultured *Chanos chanos* relative to free-living milkfish. Only one single freshwater parasite for free-living *C. chanos* is known from Indonesia (see Chapter 1.3.3.6; milkfishes live in marine, brackish and freshwater environments). Also for barramundi (*Lates calcarifer*) and Malabar grouper (*Epinephelus malabaricus*), many more parasite species are documented for aquacultured relative to free-living fish. This is due to the fact that commercially significant aquaculture has been the subject of much more frequent parasitological investigations for selected fish species compared to respective free-living fish stocks (cf. Rückert et al. 2008, 2009b, 2010).

The parasites of some fish species have been exclusively recorded from farmed or aquacultured fish, again explained through their higher commercial importance and the responsibilities of managers and owners. An additional fish order, family and various species of fish are parasitised in Indonesia exclusively investigated from aquaculture, e.g. the Napoleon Humphead wrasse *Cheilinus undulates* and the serranid Humpback and Palemargin groupers as well as Spotted coral grouper (*Cromileptes altivelis*, *Epinephelus bontoides* and *Plectropomus maculatus*, respectively). Some ornamental fishes such as *Hippocampus* spp. (sea horses, order Syngnathiformes, family Syngnathidae, not occurring in App. I.1) also have been studied only from cultivation systems.

This shows the importance of these fishes for commercial culture (further confirming **hypothesis 5**). On the other hand, the species richness of parasites is much higher for free-living lutjanid snappers and siganid rabbitfishes, the Spotted scat *Scatophagus argus* and the serranid Areolate grouper *Epinephelus areolatus*, demonstrating these fishes are less important in culture. The serranid Orange-spotted and Brown-marbled groupers (*E. coioides* and *E. fuscoguttatus*) are the only Indonesian fish species that have been intensively investigated from both natural and culture habitats, making them interesting model organisms and showing their general commercial importance, while the Camouflage grouper *E. polyphekadion* and the Leopard Coral grouper *Plectropomus leopardus* are only rarely investigated from both habitats.

This comparison further shows that the monoxenous, ectoparasitic monogeneans of the genus *Pseudorhabdosynochus* as well as members of the family Capsalidae (e.g. *Benedenia*), together with cymothoid isopods and caligid copepods are regularly recorded from mariculture farms and natural habitats, demonstrating an active invasion of these taxa into the net cages. On the other hand, heteroxenous endohelminths such as digenean trematodes of the genera *Lecithochirium* and *Prosorhynchus*, trypanorhynch cestodes and the nematode genus *Hysterothylacium* are common in both habitats, demonstrating an invasion either via intermediate hosts (e.g. invertebrates and small fishes) passing the net cages, or via infected trash fish fed to the mariculture fishes.

1.4.10 Conclusions and Outlook

This thesis with its checklist, new species descriptions and new locality and host records demonstrates that the biodiversity in Indonesia is not fully explored. In total, 3,005 parasite records of 621 parasite species from 315 free-living marine Indonesian teleost species belonging to 94 families and 18 orders are presented. Based on the host-parasite checklist, it is estimated that only 5.5% of the fish parasite biodiversity has been recorded, extending the knowledge as described by Jakob and Palm (2006) (less than 3.3% considering the now known fish species richness) by 66.6%. Future studies are urgently needed in order to better describe the real biodiversity in the region. This is especially true for the Indo West Pacific, where Cribb et al. (2016) assessed the literature from the region and reported of 2,582 trematode species infecting 1,485 fish species, with 326 fully identified trematodes species reported for the Australian Great Barrier Reef alone (Cribb et al. 2014). Justine et al. (2010) demonstrated that grouper species of the West Pacific are parasitised by a mean of ten parasite species (*E. maculatus* is host of 12 monogenean species alone (Justine 2007)), and their parasite fauna in species rich Indonesian waters might be higher. It is concluded that Indonesian waters, belonging to the coral triangle, and its diverse coral reef habitats are considered as promising targets for subsequent fish parasitological research. According to **hypotheses 1 & 2**, more fish parasite taxa, host and locality records will be established for Indonesia in future, especially due to applying new methods as described (**hypothesis 3**).

With the description of new genotypes of the roundworm genus *Anisakis* from Indonesia, molecular studies may distinguish additional, morphologically similar but genetically different species from Indonesia. Before this examination, it was speculated that the population from the Indonesian archipelago might be threatened with anisakiasis, an important fish-borne zoonosis caused by the two species *A. simplex* and *A. pegreffii* (Bao et al. 2017). However, it was demonstrated that mainly the non-zoonotic *A. typica* and a similar genotype *A. typica* var. *indonesiensis* infect Indonesian teleosts, and only a single specimen of *A. pegreffii* was found in the migrating scombrid *Auxis rochei*. With only one single *Anisakis* specimen located in the musculature of a *Selar crumenophthalmus* (Carangidae), the risk for the consumer was estimated to be low. However, it is known that 11% of the population of an East Javanese city were *Anisakis* antibody positive (Uga et al. 1996). It is concluded that, besides sampling adults of *A. typica* var. *indonesiensis* for a morphological species description, more records for *Anisakis* taxa, hosts and localities will be established for Indonesia in future according to **hypotheses 1 & 2**, especially due to applying new methods as described (**hypothesis 3**). This will further help to analyse the zoogeography of these taxa (**hypothesis 4**).

The descriptions of two new endoparasitic monogeneans including novel microscopic and molecular analyses shed more light onto this rare group of parasites (**hypotheses 1-3**). The recorded endoparasitic monogeneans appeared to have relatives in Africa, and also in freshwater (Theisen et al. 2017, 2018). This suggests that these rarely found species have a circumoceanic distribution and might be more prevalent in the Indian Ocean than currently known. It also implies that these worms can be used as a model to describe how fish parasites were able to establish larger host switches and explore new environments. The `*Diplectanotrema*-group´, after being carefully reviewed, e.g. revealing synonymies, is therefore a candidate for the study of zoogeographical patterns, phylogeny and co-evolution (**hypothesis 4**). As mentioned in Chapter 1.4.2, a *Pseudempleurosoma* sp. from a gobiid (App. I.1) was reported by Asnita (2011) and it is suggested that this is a new species that should be described (**hypotheses 1 & 2**). The newly introduced screening technique (Fig. 10, **hypothesis 3**) could expedite this project. All newly applied methods on monogenean endoparasite investigations (confocal microscope techniques, DNA analyses, phylogeny studies and screening techniques) together with the newly constructed visual identification key for the trematode genus *Bucephalus* can also be applied to further Indonesian fish parasite groups in future.

Based on the presented comparison of the parasite fauna from Indonesia and Hawaii, it is concluded that differences in the parasite group compositions are caused by the historic-geographical differences of these two archipelagos. The comparatively young Hawaiian islands must have been reached and colonised individually by each parasite taxon while and after their fish hosts arrived at these remote islands, leading to a high number of endemic species. The possibility of hermaphroditic animals to reproduce can be higher than of dioecious taxa, because a single individual, equipped with male and female genitalia, may be sufficient to invade new environments. It is concluded that further geographical comparisons, e.g. via already available checklists, are desirable in future (**hypothesis 4**).

The host-parasite checklist presented lists many parasites of aquaculture significance. A comparison with the host-parasite checklist for Indonesian aquacultured fish indicates that fish parasites of various grouper species, the Napoleon Humphead wrasse and some ornamental fishes such as sea horses have been studied only from cultivation systems. This shows the importance of these fishes for commercial culture, and the responsibilities of fish farm owners and managers to maintain the production. It is interesting to note that most of the groupers from inside aquaculture net cages as well as free-living specimens in the region are parasitised by the ectoparasitic monogenean genus *Pseudorhabdosynochus* and members of the family Capsalidae (e.g. *Benedenia*), together with crustacean parasites. These regular records from mariculture farms and natural habitats demonstrate an active invasion of these taxa into the net cages and a consistent transfer between inside and outside the net cages, illustrating the threat that the aquaculture in the region has caused (and is facing) through the high parasite biodiversity. This is also true for heteroxenous endohelminths such as digenean trematodes of the family Bucephalidae and the nematode genus *Hysterothylacium*, demonstrating an invasion either via intermediate hosts (e.g. invertebrates and small fishes) passing the net cages, or via infected trash fish fed to the mariculture fishes (**hypothesis 5**). It is therefore concluded that aquaculture in the region is both influenced by the high natural fish and parasite biodiversity and influences the natural fish stocks. Active control mechanisms suggested here, along with common practises such as medication and freshwater baths of cultured marine fishes, can be i) smaller net cage mesh sizes, ii) frequent cleaning of the net cages from algae and invertebrates, iii) the processing of trash fish to pellets, iv) an analysis of the surrounding biodiversity (parasites, fishes and further potential intermediate hosts), if possible previous to the construction and commissioning of a new mariculture facility, and v) choosing fish species that are less threatened by the known adjacent fish parasites and consequently a lower threat to the surrounding environments.

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2. Palm HW* & Theisen S*, Damriyasa IM, Kusmintarsih ES, Oka IBM, Setyowati EA, Suratma NA, Wibowo S, Kleinertz S (2017) ***Anisakis* (Nematoda: Ascaridoidea) from Indonesia.** Diseases of Aquatic Organisms 123, 141-157. *Both authors contributed equally

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Anisakis (Nematoda: Ascaridoidea) from Indonesia

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ABSTRACT: Despite Indonesia's high marine biodiversity, there is a lack of information regarding fish parasites in Indonesian waters. During a sampling of 136 teleost species from Indonesian waters, 22 of them were infected with larvae of *Anisakis* Dujardin, 1845, a genus with zoonotic potential. We genetically identified 118 worms, provide a revision of all available sequences of the ITS-1–5.8S–ITS-2 marker from Indonesian *Anisakis* in GenBank (n = 125), and establish 16 new host records. So far, 53 Indonesian teleosts harbour *Anisakis* spp., 32 of them with known sequence data, increasing the worldwide teleosts with genetically identified *Anisakis* from 155 to 177. Sequence analyses of this marker in the 243 *Anisakis* specimens identified 3 *Anisakis* sp. HC-2005 and 39 (16%) *A. typica* (sensu stricto). *A. berlandi* and *A. pegreffii* are reported for the first time from teleosts in the equatorial region and *A. physeteris* from the Pacific Ocean. The latter 3 species were exclusively found in the migratory scombrid *Auxis rochei*. Most common infection sites were the body cavity, with 299 (of 848) worms in the mesenteries surrounding the liver, and 129 unattached. Musculature infection was very low, demonstrating minor risk of anisakiasis for human consumers. A total of 193 worms (~79%) had a distinct genotype distinguished from *A. typica* by 4 positions in the ITS-1 region. This genotype is reported since 2008 as '*A. typica*', 'sibling', '*Anisakis* sp./type 1', 'sp. I', 'sp. 2' or 'sp. II'. To avoid further misleading identification, we hereby apply the subspecific entity *Anisakis typica* var. *indonesiensis* until description of the adults becomes available.

KEY WORDS: Molecular genotyping · *Anisakis typica* (s.s.) · *A. berlandi* · *A. pegreffii* · *A. physeteris* · *A. typica* var. *indonesiensis* · Anisakiasis

INTRODUCTION

The fisheries industry with its highly valuable food products is a driver for the future economic development of the maritime nation Indonesia. Consequently, food safety and food security are important to consumers. Marine fishes can be a source for foodborne, parasitic human diseases (zoonoses), primarily when larval helminths are ingested through the consumption of semi-cooked or uncooked fisheries products (e.g. Petersen et al. 1993). Some worms can survive inside the human gastrointestinal tract. Especially anisakid nematodes of the genus *Anisakis* (Anisakidae, Ascaridoidea) have been reported to cause anisakiasis, an inflammation of the human gastrointestinal tract, in many regions worldwide (Ishikura & Namiki 1989, Ishikura & Kikuchi 1990, Klimpel & Palm 2011, Ivanovic et al. 2015, Lim et al. 2015, Sohn et al. 2015, Nieuwenhuizen 2016).

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[§]Corrections were made after publication. For details see www.int-res.com/articles/dao2017/127/d127p081.pdf This version: December 19, 2017

Marine fish parasitology in Indonesia is a widely neglected field, and only a few early studies have been published in an international journal. After the first record of the zoonotic nematode genus *Anisakis* in 1954 (Yamaguti 1954), several Indonesian researchers studied the Anisakidae between 1978 and 2001 based on morphology (Burhanuddin & Djamali 1978, 1983, Hadidjaja et al. 1978, Hutomo et al. 1978, Ilahude et al. 1978, Ilahude 1980, Martosewojo 1980, Asmanelli et al. 1993, Koesharyani et al. 2001, Lester et al. 2001), adding more host fish species. Recent DNA analyses demonstrated that the genus *Anisakis* consist of 2 'clades' and different 'complexes'. Clade one includes *A. typica* (Diesing, 1860), *A. nascettii* Mattiucci et al., 2009 and its sister species *A. ziphidarum* Paggi et al., 1998, and 3 siblings forming the *A. simplex* (sensu lato, s.l.) complex: *A. simplex* (Rudolphi, 1809) (sensu stricto, s.s.), *A. pegreffii* Campana-Rouget et Biocca, 1955, and *A. berlandi* Mattiucci et al., 2014 (formerly known as *A. simplex* C of Nascetti et al., 1986). The second clade consists of 3 species forming the *A. physeteris* (s.l.) complex: *A. paggiae* Mattiucci et al., 2005, *A. brevispiculata* Dollfus, 1966, and *A. physeteris* (Baylis, 1923) (s.s.) (Klimpel & Palm 2011, Kuhn et al. 2011, 2013, Mattiucci et al. 2005, 2009, 2014). Other genotypes such as '*Anisakis* sp. HC-2005' have been rarely reported, lack morphological descriptions, and indicate further taxonomic complexity.

A. typica, the most common species in tropical fishes, has been identified from the southwest Atlantic (Brazil; Nadler et al. 2005), west (Florida; Mattiucci et al. 2005) and east Atlantic (Madeira, Portugal; Pontes et al. 2005), the Mediterranean (North Africa; Farjallah et al. 2008), the central Pacific (Hawaii and Moorea; Kuhn et al. 2013, Palm & Bray 2014), and most recently from free-living Indo-Pacific bottlenose dolphins *Tursiops aduncus* off the Hurghada coastline in the northern Red Sea, Egypt (Kleinertz et al. 2014b). Shamsi (2014) summarized the knowledge about Australian *Anisakis* spp., and identified the species *A. brevispiculata*, *A. berlandi*, *A. pegreffii* and *A. typica* in these waters adjacent to Indonesia, mentioning that *A. brevispiculata* and *A. typica* show genetic differences to the original genotypes from other areas.

Palm et al. (2008) genetically identified 3 different genotypes of *A. typica* in Balinese waters. One corresponded with *A. typica* (s.s.) from GenBank with the same sequence as material from Brazil (from the spinner dolphin *Stenella longirostris*). The most frequent genotype was distinguishable by 4 positions in the ITS-1 region, a genetic distance similar to the one between the 2 valid species *A. simplex* (s.s.) and *A. berlandi* (Palm et al. 2008). Since its first record, this genotype was also reported by Koinari et al. (2013), Kuhn et al. (2013), Anshary et al. (2014) and Kleinertz et al. (2014a), under the names *A. typica*, *Anisakis* sp. 1, 2 or I and II. The third detected genotype was scarce, and differed in 2 bp between *A. typica* (s.s.) and the Indonesian sibling.

Palm et al. (2008) provided the first infection rates and organ preferences within the fish hosts as well as a comparison of infections in north Javanese and north and south Balinese waters. Based on no muscular infection observed, the authors suggested a minor risk of *Anisakis*-borne zoonoses in Indonesia. The single published case of anisakiasis in the adjacent Philippines is a wrong citation (cf. Lymbery & Cheah 2007 with Petersen et al. 1993), but Uga et al. (1996) reported 11% of 244 tested East Javanese citizens, especially juveniles, positive for antibodies for *Anisakis* spp. in a seroepidemiological survey. The purpose of the present study was to (1) molecularly genotype the ITS-1–5.8S–ITS-2 region of *Anisakis* spp. in Indonesia throughout a high number of teleost hosts, (2) analyse the site- and host-specificity of the recorded nematodes and (3) estimate the human health risks caused by *Anisakis* spp. from Java and Bali. We hereby apply the subspecific entity *A. typica* var. *indonesiensis* for the genotype so far solely reported from Indonesia in order to avoid future misidentification.

MATERIALS AND METHODS

Parasitological examination

A total of 1801 fishes belonging to 136 species were studied from July 2010 to August 2013. A total of 1531 individuals belonged to 40 teleost species, collected in south Java (Cilacap) and south Bali, Kedonganan (mean of 39 investigated fishes per sample). One species was sampled off north Java (Karimunjawa National Park). According to the salesmen in Cilacap, 2 fish species were originally obtained off Jakarta, northern Java coast. Another sample (270 specimens of 96 species, mean of 3 animals per species) was studied during the First Educational Workshop on Marine Fish Parasites in Bali, July-August 2013. These fishes were collected from fish markets in south Bali (Kedonganan), or were caught alive in southern Balinese waters. Fishes were transferred to the laboratories on ice (or in the case of the workshop, alive in barrels with seawater and sufficient

oxygen supply), and studied at the Institute for Parasitology and Entomology, Jenderal Soedirman University, Java, and the Centre for Studies in Animal Diseases, Udayana University, Bali.

Morphometrical data for each fish species representing the same size class were taken: total and standard length (TL and SL), in mean and range to the nearest 0.1 cm, and total and gutted weight (TW and GW) to the nearest 0.1 g. The body cavity was opened and studied by naked eye. Internal organs were transferred to Petri dishes with NaCl solution (0.9%), and studied for parasites under a Zeiss Stemi DV4 binocular microscope. The musculature was sliced into 0.5 cm thin layers and pressed between a set of glass Petri dishes and then studied against a trans-illuminating light source, allowing isolation of anisakids as well as other flesh parasites.

Parasites were pre-identified under a Novel XSZ-107BN microscope to separate anisakid nematodes; these were transferred to EtOH 99.6% for molecular DNA analysis. Specimens belonging to the genus *Anisakis* are easily distinguished from other nematodes by the distinct ventricle between the oesophagus and intestine, and lack of appendages such as an anterior-directed caecum and posterior-directed appendix (Anderson 2000, Anderson et al. 2009). Ecological parameters for fish infected with *Anisakis* spp. (prevalence, intensity, abundance) were calculated following Bush et al. (1997).

DNA isolation, PCR and sequencing

A total of 118 newly collected specimens of *Anisakis* from 22 teleost species from Javanese and Balinese fish markets were used for molecular identification. Genomic DNA was isolated and purified from individual larvae by using a genomic DNA extraction kit (Peqlab Biotechnology) according to the instructions of the manufacturer. The ribosomal DNA (rDNA) region comprising the ITS-1, 5.8S, ITS-2 and flanking sequences (= ITS+) were amplified by using the previously described primers NC2 (5′-TTA GTT TCT TTT CCT CCG CT-3′) and F2662 (~TK1) (5′-GGC AAA AGT CGT AAC AAG GT-3′) (Zhu et al. 2000, Ishiwata et al. 2004, Kuhn et al. 2011). PCR reactions (50 µl) included 39 µl Master-Mix (Peqlab Biotechnology), 3 µl of each primer (10 pmol μl^{-1}), and 5 µl genomic DNA. The Master-Mix contained 5 µl ready mixed Peqlab reaction buffer Y (4 mM $MgCl_2$, 40 mM Tris-HCl [pH 8.55], 32 mM $(NH_4)_2SO_4$, 0.02% Tween 20); 0.25 µl (2.5 U) *Taq* polymerase, 1 µl (0.4 mM) dNTP and 32.75 µl water. Each PCR reaction was performed in a thermocycler (Biozym Scientific) under the following conditions: initial denaturation at 95°C for 1 min; 40 cycles of 94°C for 45 s (denaturation), 55°C for 45 s (annealing), and 72°C for 45 s (extension); followed by a final extension at 72°C for 10 min. Control samples without DNA were included in each PCR run. PCR products were examined on 1% agarose gels. A 100 bp ladder marker (Peqlab Biotechnology) was used to estimate the size of the PCR products. To identify the anisakid nematodes, PCR products were purified with the Cycle-Pure Kit (Peqlab Biotechnology). Afterwards, a total volume of 7 µl, including 2 µl primer (individually) and 5 µl of the PCR product (~250 ng μl^{-1}), were sequenced by Seqlab, Göttingen. Both spacers and the 5.8S gene from each PCR product were sequenced, using the primers TK1 and NC2.

Alignment

Sequences (forward and reverse) of the ITS-1, 5.8S and ITS-2 region were assembled and edited using the BioEdit sequence alignment editor (v. 7.1.3.0). They were compared manually with the original chromatograms, identified via GenBank and aligned with a previously characterized sequence (GenBank) data of *Ansiakis* spp., and with 125 previously identified *Anisakis* sequences from Indonesia (see Palm et al. 2008, Koinari et al. 2013, Kuhn et al. 2013, Anshary et al. 2014, Kleinertz et al. 2014a) using ClustalW (v. 1.83) multiple sequence alignments (settings: full multiple alignment, gap penalties default) (Thompson et al. 1994). They were then aligned with sequences from other *Anisakis* species from GenBank for species and genotype identification as follows: *A. typica* (s.s.) from the spinner dolphin *Stenella longirostris* from Brazil (AY826724; see Nadler et al. 2005), *A. simplex* C, now *A. berlandi* from *Mirounga angustirostris* from California (AY821739; see Nadler et al. 2005), *A. pegreffii* and *A. physeteris* from mackerels from Japan (AB277823 and AB277821 respectively; see Umehara et al. 2008), and *Anisakis* sp. HC-2005 from *Hoplostethus cadenati* from the African shelf (EU718474; see Kijewska et al. 2009). We hereby apply the subspecific entity *Anisakis typica* var. *indonesiensis* for most of the specimens recorded during the present study, and for the specimens from *Auxis rochei* from Indonesia (EU346093; see Palm et al. 2008). Because we do not nominate an available name but apply the subspecific entity, we must not follow the ICZN (2016, their §1.3). New nucleotide sequence data are available in GenBank (accession numbers KY524195–KY524217).

RESULTS

Parasite infection

A total of 6 different genotypes of *Anisakis* were identified, including *Anisakis* sp. HC-2005, *A. berlandi*, *A. pegreffii*, *A. physeteris*, *A. typica* (s.s.), and an Indonesian *A. typica* genotype for which we hereby apply the subspecific entity *A. typica* var. *indonesiensis*. This allows distinction of all thus far analysed *A. typica* from Indonesian waters, formerly named *A. typica*, *Anisakis* sp., sp. 1, sp. 2, I and II into 2 distinct genotypes. *A. berlandi* and *A. pegreffii* are hereby reported for the first time from teleost hosts from a tropical locality, and *A. physeteris* from the Pacific Ocean. During the detailed parasite sampling with at least 20–75 fish specimens per sample (39 in general), 16 of 40 teleost hosts were found to be infected with *Anisakis* spp. in Indonesian waters. Six fish species were found to be infected during the smaller samplings at the Bali workshop in 2013. The infected fish species are given in Tables 1 & 2. The *Anisakis*-negative fish species of the former, detailed sampling, mainly from Cilacap, south Central Java (other origins are mentioned), were Caesionidae: *Caesio cuning* (n = 35, mean TL [mTL] = 21.7 cm), *Pterocaesio diagramma* (n = 20, mTL = 21.9 cm) (both from Kedonganan); Carangidae: *Alepes melanoptera* (n = 20, mTL = 23.0 cm), *Atropus atropos* (n = 35, mTL = 16.4 cm), *Atule mate* (n = 75, mTL = 23.4 cm) (35 from Kedonganan), *Caranx heberi* (n = 35, mTL = 21.2 cm), *Parastromateus niger* (n = 40, mTL = 19.4 cm), *Selar boops* (n = 37, mTL = 17.5 cm); Cichlidae: *Oreochromis mossambicus* (n = 35, mTL = 16.9 cm); Clupeidae: *Amblygaster sirm* (n = 35, mTL = 18.9 cm), *Nematalosa come* (n = 35, mTL = 21.8 cm), *Sardinella lemuru* (n = 35, mTL = 19.4 cm) (the latter 2 from Kedonganan); Cynoglossidae: *Cynoglossus* cf. *arel* (n = 35, mTL = 27.6 cm); Haemulidae: *Pomadasys kaakan* (n = 35, mTL = 19.7 cm); Lutjanidae: *Lutjanus vitta* (n = 35, mTL = 20.1 cm; however, the low sample survey from the workshop was infected); Nemipteridae: *Nemipterus japonicus* (n = 35, mTL = 20.6 cm); Sciaenidae: *Nibea soldado* (n = 35, mTL = 23.3 cm), *Otolithes ruber* (n = 30, mTL = 17.6 cm), *Pennahia macrocephalus* (n = 40, mTL = 17.6 cm); Scombridae: *Rastrelliger kanagurta* (n = 35, mTL = 23.8 cm), *Sarda orientalis* (n = 35, mTL = 29.3 cm) (Kedonganan); Epinephelidae: *Epinephelus fuscoguttatus* (aquaculture, n = 75, mTL = 26.0 cm); Sparidae: *Acanthopagrus berda* (n = 35, mTL = 21.6 cm); and Stromateidae: *Pampus argenteus* (n = 35, mTL = 22.0 cm).

A total of 22 fish species were found to be infected with *Anisakis* spp., and 16 new host records could be established (Table 2). Revision of 125 available sequence data allowed confirmation of 53 *Anisakis*-infected fish host species from Indonesia, including 32 with genetically confirmed identity (Tables 3 & 4). Table 2 presents the infection rates (prevalence, intensity, abundance) within the macrohabitat (~fish host species) and the site of infection (microhabitat). Because some data go back to earlier studies that allow no molecular identification without further sampling, Table 2 refers in these cases to '*Anisakis* spp.'

Highest infection rates were documented for the scombrid *Auxis rochei* and the carangid *Selar crumenophthalmus* (prevalence of 97.2% and 81.1% respectively). In both fish species, the range of microhabitats was widest (Table 2). We isolated 848 worms, almost all from the body cavity, free or attached to the outer tissues of various organs and/or the mesenteries, with just a single exception: One worm was isolated from the muscle tissue (filet) of a *S. crumenophthalmus*. The preferred sites for attachment were the liver (n = 299), gonads (n = 138), stomach (n = 136), body cavity (freely) (n = 131), intestine (n = 95), pyloric caeca (n = 45). The swim bladder, gill cavity, fins and muscle tissue (filet) were generally uninfected (n = 1 for each of the latter). Infections in gills and fins are unusual for this endoparasite and probably the effect of e.g. everted stomachs or a post-mortem migration (Table 2). The selected size range of the studied fish of a respective species was similar, preventing detailed comparison of different size classes. Male and female fishes had infection levels as follows: (1) *Auxis rochei*: 135 worms were isolated from 12 males, while 532 worms originated from 24 females; (2) *Selar crumenophthalmus*: 18 males harboured 44 worms while 7 females harboured 19 *Anisakis*; (3) *Terapon jarbua*: 8 worms from 17 males and 9 worms from 18 females; and (4) *Priacanthus tayenus*: 7 worms were obtained from 24 males and 8 worms from 11 females. A total of 797 of the 848 worms (~94%) were sampled during the dry season, with the remaining 51 specimens (~6%) during the rainy season. A total of 804 worms (~95%) originated from Kedonganan, Bali, and 44 (~5%) from Cilacap, south Java (although similar fish quantities were analysed from rainy vs. dry seasons respectively in Cilacap vs. Kedonganan; cf. Tables 1 & 2).

Table 1. Fish samples infected by *Anisakis* spp., with locality, season, number of sampled individuals (n_{fish}), total length (TL), total weight (TW), gutted weight (GW) in mean and range, and number of males (M), females (F) and juveniles (J). Additional fish species samples hosting *Anisakis* (workshop, dry season 2013): *Brama* cf. *orcini* (Bramidae) (n = 1), *Epinephelus areolatus* (Epinephelidae) (n = 3), *E. longispinis* (Epinephelidae) (n = 1), *Lutjanus argentimaculatus* (Lutjanidae) (n = 1), *L. vitta* (Lutjanidae) (n = 3), and *Sufflamen fraenatum* (Balistidae) (n = 2)

Fish species and family	Area	Season, year	n_{fish}	TL (cm)	TW (g)	GW (g)	M	F	J
Auxis rochei (Scombridae)	Kedonganan	Dry, 2010	36	30.7 (27.6–33.5)	357.9 (240.2–459.9)	295.5 (191.3–393.8)	12	24	–
A. thazard (Scombridae)	Kedonganan	Dry, 2010	35	28.3 (25.7–31.5)	269.8 (201.2–384.5)	232.2 (167.3–303.3)	–	–	35
Decapterus macrosoma (Carangidae)	Kedonganan	Rainy, 2011	35	20.5 (19.1–22.5)	76.2 (61.4–98.8)	66.3 (50.7–87.3)	14	21	–
D. tabl (Carangidae)	Kedonganan	Dry, 2010	35	18.0 (17.1–19.1)	50.3 (43.2–58.7)	45.6 (39.3–53.0)	–	–	35
Epinephelus ongus (Epinephelidae)	Karimunjawa	Rainy, 2013	35	25.5 (20.5–30.4)	266.3 (108.5–498.0)	238.0 (99.8–463.6)	7	23	5
E. sexfasciatus (Epinephelidae)	Jakarta	Rainy, 2012	41[a]	25.1 (23.1–27.8)	240.5 (189.0–352.4)	225.1 (176.6–325.9)	–	41	–
Megalaspis cordyla (Carangidae)	Kedonganan	Dry, 2010	35[b]	32.5 (29.5–36.0)	303.9 (246.3–403.7)	282.0 (226.7–373.4)	20	15	–
Nemipterus furcosus (Nemipteridae)	Kedonganan	Dry, 2010	35	24.4 (22.7–26.6)	165.8 (136.1–231.1)	151.3 (119.5–210.7)	11	24	–
Opisthopterus tardoore (Pristigasteridae)	Cilacap	Rainy, 2011	35	21.0 (18.6–23.7)	52.9 (36.6–68.1)	50.1 (35.2–63.5)	9	26	–
Pomadasys maculatus (Haemulidae)	Cilacap	Rainy, 2012	35	18.2 (16.5–22.0)	104.3 (71.6–194.5)	94.4 (62.0–169.5)	18	17	–
Priacanthus tayenus (Priacanthidae)	Cilacap	Rainy, 2011	35	26.3 (21.7–31.2)	177.8 (137.0–238.6)	160.6 (121.0–213.7)	24	11	–
Scomberoides tol (Carangidae)	Cilacap	Rainy, 2012	35	27.6 (24.0–31.0)	138.4 (90.0–207.5)	120.3 (80.7–170.0)	9	26	–
Selar crumenophthalmus (Carangidae)	Kedonganan	Dry, 2010	37[c]	18.34 (15.5 – 20.0)	72.5 (46.2–93.4)	61.8 (38.5–81.0)	18	7	12
Selaroides leptolepis (Carangidae)	Cilacap	Dry, 2011	25[d]	15.1 (14.0–16.8)	38.5 (31.6–50.3)	36.4 (29.9–49.0)	15	10	–
Terapon jarbua (Terapontidae)	Cilacap	Rainy, 2011	35	24.2 (20.3–28.9)	201.7 (107.7–310.0)	180.6 (94.8–265.2)	17	18	–
Trichiurus lepturus (Trichiuridae)	Kedonganan	Dry, 2010	35	59.4 (48.2–67.9)	154.2 (95.6–225.1)	145.1 (87.8–205.1)	25	10	–

[a]Sample bought in Cilacap, but originated from Jakarta according to salesman. Another sample of 35 fishes from Cilacap did not harbour any *Anisakis*
[b]A second sample of 40 fishes from Cilacap did not harbour any *Anisakis*
[c]A second sample of 25 fishes from Cilacap did not harbour any *Anisakis*
[d]Additional 8 specimens from Kedonganan (workshop, dry season 2013) without morphometric measurements

Molecular analyses

The ITS rDNA sequence data of 243 Indonesian larvae of *Anisakis* spp. (118 from the present study and 125 from previously sequenced helminths, named in the literature as e.g. real, original, 'sensu stricto' *typica*, '*typica* sibling', or *Anisakis* sp./type 1, sp. 2, sp. I, sp. II) from 32 different bony fishes revealed the presence of 4 valid *Anisakis* species (Tables 3 & 4): *A. physeteris* (n = 4), *A. pegreffii* (n = 1), *A. berlandi* (n = 2) and *A. typica* (s.s.) (n = 39). One further genotype, as defined and illustrated by Palm et al. (2008), was predominantly found. We hereby apply the subspecific entity *A. typica* var. *indonesiensis* for these specimens. These 193 (~79%) worms showed a 4 bp difference at identical positions in the ITS-1 region to the closely related *A. typica* (s.s.) (for alignment, see Palm et al. 2008). The genetic distance by using ~903 informative bp was the same to the one between 2 valid species, *A. simplex* (s.s.) and *A. berlandi* (4 bp). This genotype was isolated from 28 out of 32 fish species with genetically identified *Anisakis* infection (~88%). On the other hand, *A. typica* (s.s.) (16% of the analysed worms) was documented in only 28% (9/32) of

Table 2. Infected fish species with number of *Anisakis* individuals genetically identified (total $n_{Anisakis}$ DNA-analysed = 118) and infection rates, with total number of specimens ($n_{Anisakis}$ documented), prevalence (P) (proportion of infected hosts among all hosts examined), mean intensity (mI) (mean number of *Anisakis* found in infected hosts), mean abundance (mA) (mean number of *Anisakis* found in all hosts), and infection sites (all data from this study) (bcv: body cavity, gcv: gill cavity; go: gonads; in: intestine; li: liver; mus: muscle tissue; pyl: pylorus; st: stomach; swb: swim bladder). Worms were not isolated from inner lumen of organs, but were located outside, attached to organs or mesenteries. Thus, all worms originated from the body cavity (except the one from muscle), sometimes free-living and sometimes attached to organs

Fish species and family	$n_{Anisakis}$ documented	P (%)	mI (range)	mA	Site of infection	$n_{Anisakis}$ DNA-analysed
Auxis rochei (Scombridae)	667	97.2	19.1 (1–275)	18.53	293 (li), 125 (go), 115 (st), 64 (in), 46 (bcv), 24 (pyl)	24
A. thazard (Scombridae)	10	22.9	1.3 (1–3)	0.29	7 (bcv), 3 (li)	10
Decapterus macrosoma[a] (Carangidae)	8	20.0	1.1 (1–2)	0.23	4 (bcv), 1 (swb), 1 (st), 1 (go), 1 (in)	8
D. tabl[a] (Carangidae)	12	25.7	1.2 (1–2)	0.31	10 (bcv), 2 (st)	12
Epinephelus ongus[a] (Epinephelidae)	3	8.6	1.0 (1)	0.09	1 (go), 1 (in), 1 (pyl)	1
E. sexfasciatus[a] (Epinephelidae)	3	8.6	1.0 (1)	0.09	1 (go), 1 (in), 1 (pyl)	3
Megalaspis cordyla[a] (Carangidae)	1	2.9	1.0 (1)	0.03	1 (li)	1
Nemipterus furcosus[a] (Nemipteridae)	3	5.7	1.5 (1–2)	0.06	2 (go), 1 (st)	3
Opisthopterus tardoore[a] (Pristigasteridae)	2	5.7	1.0 (1)	0.06	1 (pyl), 1 (bcv)	2
Pomadasys maculatus[a] (Haemulidae)	1	2.9	1.0 (1)	0.03	1 (in)	1
Priacanthus tayenus[a] (Priacanthidae)	15	34.3	1.3 (1–2)	0.43	13 (in), 1 (pyl), 1 (bcv)	10
Scomberoides tol[a] (Carangidae)	2	5.7	1.0 (1)	0.06	1 (go), 1 (bcv)	2
Selar crumenophthalmus (Carangidae)	91	81.1	3.0 (1–8)	2.46	49 (bcv), 15 (pyl), 11 (st), 7 (in), 6 (go), 1 (gcv), 1 (fin), 1 (mus)	16
Selaroides leptolepis[a] (Carangidae)	1	4.0	1.0 (1)	0.04	1 (go)	1
Terapon jarbua (Terapontidae)	17	37.1	1.3 (1–3)	0.49	6 (st), 5 (in), 2 (pyl), 2 (li), 2 (bcv)	12
Trichiurus lepturus (Trichiuridae)	1	2.9	1.0 (1)	0.03	1 (in)	1
Additional *Anisakis*-hosting fish species investigated during low-sample spot survey (workshop 2013):						
Brama cf. *orcini*[a] (Bramidae)	1				1 (in)	1
E. areolatus (Epinephelidae)	5				5 (bcv)	5
E. longispinis[a] (Epinephelidae)	1				1 (bcv)	1
Lutjanus argentimaculatus[a] (Lutjanidae)	1				1 (bcv)	1
L. vitta[a] (Lutjanidae)	2				2 (bcv)	2
Sufflamen fraenatum[a] (Balistidae)	1				1 (bcv)	1

[a]New *Anisakis* host record for Indonesia (n = 16)

Table 3. Host records of *Anisakis* spp. from Indonesia. *Anisakis typica* var. *indonesiensis* (*A. t. indonesiensis*) represents the local genotype

Fish host: family and species	Parasite	Locality	Reference	DNA sequenced
Ariommatidae				
Ariomma indicum (= *A. indica*)[a]	*Anisakis* sp.	S. Java	Theisen (2009)	
Balistidae				
Sufflamen fraenatum	*Anisakis* sp. HC-2005	Bali	Present study	Yes
Bramidae				
Brama dussumieri	*Anisakis* sp.	S. Java	Jakob & Palm (2006)	
Brama cf. *orcini*	*A. t. indonesiensis*	Bali	Present study	Yes
Caesionidae				
Caesio cuning	*A. t. indonesiensis*	Bali, 'Indonesia'	Palm et al. (2008), Kuhn et al. (2013)	Yes
Caesio sp.	*Anisakis* sp.	S. Java	Setyobudi et al. (2011)	
Carangidae				
Atule mate	*Anisakis* sp.	N. Java	Ilahude et al. (1978), Ilahude (1980)	
Caranx sp.	*A. typica* (s.l.)[b]	Makassar Strait	Anshary et al. (2014), Anshary pers. comm. (Feb 2015)	
Decapterus kurroides	Anisakidae	N. Java	Burhanuddin & Djamali (1983)	
D. macarellus	*A. t. indonesiensis*	Papua New Guinea	Koinari et al. (2013)	Yes
D. macrosoma	*A. t. indonesiensis*	Bali	Present study	Yes
D. russelli (= *D. lajang*)[a]	*Anisakis* sp.	Bali, Java	Burhanuddin & Djamali (1978, 1983), Hadidjaja et al. (1978), Hutomo et al. (1978), Martosewojo (1980), Palm et al. (2008)	
D. tabl	*A. typica* (s.s.)	Bali	Present study	Yes
	A. t. indonesiensis	Bali	Present study	Yes
Megalaspis cordyla	*A. t. indonesiensis*	Bali	Present study	Yes
Scomberoides tol	*A. t. indonesiensis*	S. Java	Present study	Yes
Selar crumenophthalmus (= *Caranx crumenophthalmus*)[a]	*Anisakis* sp.	N. Java	Ilahude et al. (1978), Ilahude (1980)	
	A. typica (s.s.)	Papua New Guinea, Bali	Koinari et al. (2013), present study	Yes
	A. t. indonesiensis	Bali	Present study	Yes
Selaroides leptolepis	*A. t. indonesiensis*	S. Java	Present study	Yes
Clupeidae				
Amblygaster sirm	*Anisakis* sp.	N. Java, Sunda Strait	Hadidjaja et al. (1978), Hutomo et al. (1978), Martosewojo (1980), Burhanuddin & Djamali (1983)	
Sardinella fimbriata	Anisakidae	N. Java, Sunda Strait	Burhanuddin & Djamali (1983)	
S. gibbosa (= *jussieuii*)[a]	*Anisakis* sp.	N. Java, Sunda Strait	Ilahude et al. (1978), Ilahude (1980)	
Coryphaenidae				
Coryphaena hippurus	*A. typica* (s.s.)	S. Java	Palm et al. (2008)	Yes
	A. t. indonesiensis	S. Java	Palm et al. (2008)	Yes
Epinephelidae				
Cephalopholis cyanostigma	*A. typica* (s.l.)[b]	Makassar Strait	Anshary et al. (2014), H. Anshary (pers. comm.)	
Cromileptes altivelis	Anisakidae	Bali	Koesharyani et al. (2001)	
Epinephelus areolatus	*A. t. indonesiensis*	S. Java, Bali	Palm et al. (2008), Kleinertz et al. (2014a), present study	Yes
	Anisakis sp. HC-2005	S. Java	Kleinertz et al. (2014a)	Yes
E. fuscoguttatus	*Anisakis* sp.	N. Java, Sulawesi	Burhanuddin & Djamali (1983), Asmanelli et al. (1993)	
E. longispinis	*A. t. indonesiensis*	Bali	Present study	Yes
E. maculatus	Anisakidae	N. Java	Burhanuddin & Djamali (1983)	
E. ongus	*A. t. indonesiensis*	N. Java	Present study	Yes
E. quoianus (= *E. megachir*)[a]	Anisakidae	N. Java, Sulawesi	Burhanuddin & Djamali (1983)	
E. sexfasciatus	*A. t. indonesiensis*	N. Java	Present study	Yes
E. summana (~ *E. ongus* or *E. coeruleopunctatus*)[c]	Anisakidae	N. Java	Burhanuddin & Djamali (1983)	

(Table continued on next pages)

Table 3 (continued)

Fish host: family and species	Parasite	Locality	Reference	DNA sequenced
Plectropomus leopardus	*Anisakis* sp.	Bali, Sulawesi	Asmanelli et al. (1993), Koesharyani et al. (2001)	
Gempylidae				
Gempylus serpens	*Anisakis* sp.	S. Java	Jakob & Palm (2006)	
Thyrsitoides marleyi	*Anisakis* sp.	S. Java	Jakob & Palm (2006)	
Gerreidae				
Gerres oblongus	*A. t. indonesiensis*	Papua New Guinea	Koinari et al. (2013)	Yes
Haemulidae				
Pomadasys maculatus	*A. t. indonesiensis*	S. Java	Present study	Yes
Leiognathidae				
Leiognathus dussumieri	*Anisakis* sp.	Sulawesi	Yamaguti (1954)	
Lutjanidae				
Lutjanus argentimaculatus	*A. t. indonesiensis*	Bali	Present study	Yes
L. kasmira	Anisakidae	N. Java	Ilahude (1980)	
L. malabaricus	*Anisakis* sp.	S. Java	Setyobudi et al. (2011)	
L. vitta	*A. t. indonesiensis*	Bali	Present study	Yes
Pinjalo lewisi	*A. t. indonesiensis*	Papua New Guinea	Koinari et al. (2013)	Yes
P. pinjalo	*A. t. indonesiensis*	Papua New Guinea	Koinari et al. (2013)	Yes
Mullidae				
Parupeneus sp.	*Anisakis* sp.	S. Java	Setyobudi et al. (2011)	
Nemipteridae				
Nemipterus furcosus	*A. t. indonesiensis*	Bali	Present study	Yes
Platycephalidae				
Platycephalus endrachtensis (= *P. arenarius*)[a]	*Anisakis* sp.	S. Java	Theisen (2009)	
Priacanthidae				
Priacanthus tayenus	*A. t. indonesiensis*	S. Java	Present study	Yes
Pristigasteridae				
Opisthopterus tardoore	*A. t. indonesiensis*	S. Java	Present study	Yes
Scombridae				
Auxis rochei rochei	*A. typica* (s.s.)	'Indonesia', Bali	Palm et al. (2008), Kuhn et al. (2013), present study	Yes
	A. typica × *A. t. indonesiensis*	Bali	Palm et al. (2008)	Yes
	A. t. indonesiensis	'Indonesia', Bali	Palm et al. (2008), Kuhn et al. (2013), present study	Yes
	A. pegreffii	Bali	Present study	Yes
	A. physeteris	Bali	Present study	Yes
	A. berlandi	Bali	Present study	Yes
A. thazard thazard	*A. typica* (s.s.)	Makassar Strait, Bali	Anshary et al. (2014), H. Anshary (pers. comm.), present study	Yes
	A. t. indonesiensis	'Indonesia', Makassar Strait, Bali	Kuhn et al. (2013), Anshary et al. (2014), H. Anshary (pers. comm.), present study	Yes
Euthynnus affinis	*Anisakis* sp.[d]	N. Java	Ilahude et al. (1978), Burhanuddin & Djamali (1983)	
	A. typica (s.l.)[b]	Makassar Strait	Anshary et al. (2014), H. Anshary (pers. comm.)	
Katsuwonus pelamis	*A. t. indonesiensis*	Makassar Strait	Anshary et al. (2014), H. Anshary (pers. comm.)	Yes
Rastrelliger brachysoma	*Anisakis* sp.	N. Java	Ilahude et al. (1978), Ilahude (1980)	
R. kanagurta	*Anisakis* sp.	N. Java	Hadidjaja et al. (1978), Hutomo et al. (1978), Martosewojo (1980), Burhanuddin & Djamali (1983)	
	A. typica (s.l.)[b]	Makassar Strait	Anshary et al. (2014), H. Anshary (pers. comm.)	
Scomberomorus commerson	Anisakidae[d,e]	N. Java	Burhanuddin & Djamali (1983)	
	A. simplex[e]	Kupang	Lester et al. (2001)	

Table 3 (continued)

Fish host: family and species	Parasite	Locality	Reference	DNA sequenced
S. maculatus (~ *S. queenslandicus* or *S. guttatus*)[f]	*A. typica* (s.s.)	Papua New Guinea	Koinari et al. (2013)	Yes
Thunnus albacares	*A. typica* (s.s.)	Papua New Guinea	Koinari et al. (2013)	Yes
Siganidae				
Siganus guttatus	Anisakidae	N. Java	Burhanuddin & Djamali (1983)	
Synodontidae				
Saurida isarankurai	Anisakidae	N. Java	Burhanuddin & Djamali (1983)	
S. longimanus	Anisakidae	N. Java	Burhanuddin & Djamali (1983)	
S. micropectoralis	Anisakidae	N. Java	Burhanuddin & Djamali (1983)	
S. undosquamis	Anisakidae	N. Java	Burhanuddin & Djamali (1983)	
Terapontidae				
Terapon jarbua	*A. t. indonesiensis*	S. Java	Present study	Yes
	Anisakis sp.	S. Java	Setyobudi et al. (2011)	
Trichiuridae				
Lepturacanthus savala	*A. t. indonesiensis*	'Indonesia'	Kuhn et al. (2013)	Yes
	Anisakis sp. HC-2005	'Indonesia'	Kuhn et al. (2013)	Yes
Trichiurus lepturus	*Anisakis* sp.	S. Java	Jakob & Palm (2006), Theisen (2009), Setyobudi et al. (2011)	
	A. t. indonesiensis	'Indonesia'	Kuhn et al. (2013)	Yes
	A. typica (s.s.)	'Indonesia', Bali	Kuhn et al. (2013), present study	Yes

[a]Misapplied/junior/senior synonym name used in the original reference
[b]*A. typica* (s.l.) means that PCR-RFLP resulted in *A. typica*, but could not distinguish *A. typica* (s.s.) from *A. typica* var. *indonesiensis*
[c]*E. summana* is endemic to the Red Sea and not known from Indonesia; *E. ongus* and *E. coeruleopunctatus* (and also *E. corallicola* and *E. macrospilos*) from the Indo-Pacific have often been misidentified as *E. summana* in the past (Fischer & Whitehead 1974, Heemstra & Randall 1993, Froese & Pauly 2016)
[d]*A. typica* documented in the same intermediate fish hosts from other localities (Mattiucci et al. 2002)
[e]Lester et al. (2001) recorded *A. simplex* from Kupang, Timor, on a morphological basis (must be confirmed)
[f]*S. maculatus* is not known from the Pacific but from the Atlantic. Similar species from the region are *S. queenslandicus* (spots and dark dorsal fin) and *S. guttatus* (spots)

the infected fish species. We also documented a single specimen of *Anisakis* sp. HC-2005. Of all 243 genetically identified *Anisakis* from Indonesia since 2008, there was only a single specimen with an intermediate sequence at the same positions, differing from both *A. typica* (s.s.) and the Indonesian genotype in 2 positions in the ITS-1 region each (Palm et al. 2008, their Figs. 1 & 2). It must be stated that analysing deposited sequences from GenBank from different studies and authors without having the original chromatogram resulted in some observed sequence differences. However, they appeared randomly in both *A. typica* and *A. typica* var. *indonesiensis*, and were considered uninformative.

Host range

Both documented *A. berlandi* specimens and the single *A. pegreffii* were isolated from the pelagic, oceanodromous and migratory scombrid *Auxis rochei*. Also, the 4 specimens of *A. physeteris* were isolated from *A. rochei*, which also hosted the single additional genotype with an intermediate sequence, a mixture of *A. typica* (s.s.) and *A. typica* var. *indonesiensis*, documented by Palm et al. (2008). One of the 3 *Anisakis* sp. HC-2005 from Indonesia is known from the benthopelagic trichiurid *Lepturacanthus savala* (Kuhn et al. 2013), the other from the reef-associated grouper *Epinephelus areolatus* (Kleinertz et al. 2014a) and the third from the reef-associated balistid *Sufflamen fraenatum* (present study). The 2 others, *A. typica* (s.s.) and the Indonesian sibling *A. typica* var. *indonesiensis*, occurred in various fish species: *A. typica* was isolated from 9 teleost hosts with a (bentho)-pelagic, oceanodromous and usually schooling, migratory ecology (in general, scombrids, carangids, trichiurids and 1 coryphaenid). On the other hand, the Indonesian *A. typica* var. *indonesiensis* seems to have no preference of a certain fish host ecology, infecting

Table 4. Molecular identity and distribution of *Anisakis* spp. (in % and absolute numbers) from Indonesian waters with teleost host and ecology (118 of 243 worms from present study, 125 worms from previous studies; see Table 3). Habitat data from Froese & Pauly (2016)

Fish host: family and species	Habitat	*A. berlandi*	*A. pegreffii*	*A. physeteris*	*Anisakis* sp. HC-2005	*A. typica* (s.s.)	*A. typica* (s.s.) × *A. t. indonesiensis*	*A. typica* var. *indonesiensis*
Balistidae								
Sufflamen fraenatum	Reef-associated	0	0	0	100% (1/1)	0	0	0
Bramidae								
Brama cf. *orcini*	Epi-/benthopelagic	0	0	0	0	0	0	100% (1/1)
Caesionidae								
Caesio cuning	Reef-associated	0	0	0	0	0	0	100% (11/11)
Carangidae								
Decapterus macarellus	Pelagic, schooling	0	0	0	0	0	0	100% (1/1)
D. macrosoma	Pelagic, schooling	0	0	0	0	0	0	100% (8/8)
D. tabl	Pelagic, schooling	0	0	0	0	50% (6/12)	0	50% (6/12)
Megalaspis cordyla	Oceanic, schooling	0	0	0	0	0	0	100% (1/1)
Scomberoides tol	Reef-associated, near surface, schooling	0	0	0	0	0	0	100% (2/2)
Selar crumenophthalmus	Pelagic, schooling	0	0	0	0	24% (4/17)	0	76% (13/17)
Selaroides leptolepis	Demersal, schooling	0	0	0	0	0	0	100% (1/1)
Frequency of occurrence in carangids (%)		0	0	0	0	24% (10/42)	0	76% (32/42)
Coryphaenidae								
Coryphaena hippurus	Oceanodromous, schooling	0	0	0	0	14% (1/7)	0	86% (6/7)
Epinephelidae								
Epinephelus areolatus	Reef-associated	0	0	0	4% (1/28)	0	0	96% (27/28)
E. longispinis	Reef-associated	0	0	0	0	0	0	100% (1/1)
E. ongus	Reef-associated	0	0	0	0	0	0	100% (1/1)
E. sexfasciatus	Reef-associated	0	0	0	0	0	0	100% (3/3)
Frequency of occurrence in epinephelids (%)		0	0	0	3% (1/33)	0	0	97% (32/33)
Gerreidae								
Gerres oblongus	Reef-associated, benthic, schooling	0	0	0	0	0	0	100% (1/1)
Haemulidae								
Pomadasys maculatus	Reef-associated, benthic	0	0	0	0	0	0	100% (1/1)
Lutjanidae								
Lutjanus argentimaculatus	Reef-associated, oceanodromous	0	0	0	0	0	0	100% (1/1)
L. vitta	Reef-associated	0	0	0	0	0	0	100% (2/2)
Pinjalo lewisi	Reef-associated, oceanic, schooling	0	0	0	0	0	0	100% (2/2)
P. pinjalo	Reef-associated, oceanic, schooling	0	0	0	0	0	0	100% (1/1)
Frequency of occurrence in lutjanids (%)		0	0	0	0	0	0	100% (6/6)
Nemipteridae								
Nemipterus furcosus	Reef-associated, benthic, neritic, oceanic	0	0	0	0	0	0	100% (3/3)
Priacanthidae								
Priacanthus tayenus	Reef-associated, benthic, neritic, oceanic	0	0	0	0	0	0	100% (10/10)

(Table continued on next page)

Table 4 (continued)

Fish host: family and species	Habitat	*A. berlandi*	*A. pegreffii*	*A. physeteris*	*Anisakis* sp. HC-2005	*A. typica* (s.s.)	*A. typica* (s.s.) × *A. t. indonesiensis*	*A. typica* var. *indonesiensis*
Pristigasteridae								
Opisthopterus tardoore	Pelagic, neritic, oceanodromous	0	0	0	0	0	0	100% (2/2)
Scombridae								
Auxis rochei	Pelagic, oceanodromous, schooling	4% (2/46)	2% (1/46)	9% (4/46)	0	24% (11/46)	2% (1/46)	59% (27/46)
A. thazard	Pelagic, oceanodromous, schooling	0	0	0	0	23% (7/30)	0	77% (23/30)
Katsuwonus pelamis	Pelagic, oceanodromous, schooling	0	0	0	0	100% (5/5)	0	0
Scomberomorus maculatus[a]	Pelagic, oceanodromous, schooling	0	0	0	0	100% (1/1)	0	0
Thunnus albacares	Pelagic, oceanodromous, schooling	0	0	0	0	100% (1/1)	0	0
Frequency of occurrence in scombrids (%)		2.4% (2/83)	1.2% (1/83)	4.8% (4/83)	0	30.1% (25/83)	1.2% (1/83)	60.2% (50/83)
Terapontidae								
Terapon jarbua	Demersal, schooling	0	0	0	0	0	0	100% (12/12)
Trichiuridae								
Lepturacanthus savala	Benthopelagic	0	0	0	33% (1/3)	0	0	66% (2/3)
Trichiurus lepturus	Benthopelagic	0	0	0	0	11% (3/27)	0	89% (24/27)
Frequency of occurrence in trichiurids (%)		0	0	0	3% (1/30)	10% (3/30)	0	87% (26/30)
Frequency of occurrence in total (%)		0.8% (2/243)	0.4% (1/243)	1.7% (4/243)	1.2% (3/243)	16.1% (39/243)	0.4% (1/243)	79.4% (193/243)

[a]*S. maculatus* (data/identification from Koinari et al. 2013, see our Table 3) is not known from the Pacific but from the Atlantic, thus a misidentification. Similar species from the region are *S. queenslandicus* (spots and dark dorsal fin) and *S. guttatus* (spots) (Froese & Pauly 2016)

a wide range of (bentho)pelagic, oceanodromous and usually schooling, migratory as well as reef-associated and even demersal fish species. Besides single fish species of the respective families, we also analysed the sequences of pooled *Anisakis* from 7 different carangids (*A. typica*: 23.8%; *A. typica* var. *indonesiensis*: 76.2%), 4 lutjanids (*A. typica* var. *indonesiensis*: 100%), 5 scombrids (*A. typica*: 30.1%; *A. typica* var. *indonesiensis*: 60.2%), 3 groupers (epinephelids) (*A. typica* var. *indonesiensis*: 97%) and 2 trichiurids (*A. typica*: 7.1%; *A. typica* var. *indonesiensis*: 90.5%) (Table 4).

DISCUSSION

The present study provides a comprehensive screening and molecular identification of *Anisakis* spp. from Indonesian waters. Establishing 16 new host records, 53 teleost species are known to be infected with *Anisakis* in Indonesia, demonstrating the low host-specificity and wide distribution of these taxa.

Hosts and life cycle

According to Kuhn et al. (2013), the most common teleosts for *Anisakis* larvae are perciform (57 species) and gadiform (21) species belonging to the fish families Scombridae (12), Gadidae (10), Carangidae (8) and Clupeidae (7), depending on locality and depth of study in the respective region. Abollo et al. (2001) and Klimpel et al. (2004) reported 200 fish species worldwide to be infected with *Anisakis* larvae, 155 of

them with genetic evidence (Kuhn et al. 2013). Since then, new collections with genetically identified worms have originated from teleosts already stated in Kuhn et al. (2013) (Anshary et al. 2014, Bak et al. 2014, Mladineo & Poljak 2014, Chen & Shih 2015, Cipriani et al. 2015), or from mammalian definitive hosts (i.e. Shamsi 2014, Blažeković et al. 2015). With 53 *Anisakis*-hosting fish species presented in this study, about one-quarter of the worldwide known *Anisakis* fish host species and one-third of the worldwide hosts of genetically identified *Anisakis* genotypes have been reported from Indonesia, even though this country is comparatively understudied, considering its high biodiversity. Sixteen of 40 thoroughly sampled fish species (high-amount fish samples during this study) were infected in this present study, so 40% harboured *Anisakis* spp. Indonesia is one of the most diverse marine regions in the world, with 3600 marine teleost species (Froese & Pauly 2016). It can be expected that many further host records for *Anisakis* spp. will occur in future samplings from the region, because we even recorded *Anisakis* from the low-amount fish samples during the workshop, demonstrating the low host-specificity in the region (see Tables 1–4).

Of the 6 different genetically identified *Anisakis* genotypes, 4 of them were identified to species level. A total of 16.1% of the samples, infecting 9/32 host species, belonged to *A. typica* (s.s.) (Table 4), a species known from many tropical regions throughout the world. Palm et al. (2008) have already reported this species in teleosts from Indonesia, especially in *Coryphaena hippurus* and *Auxis rochei rochei*. The larvae have been found in scombrids and carangids such as *Auxis thazard thazard* and *Thunnus thynnus* from Brazil (SW Atlantic); *Scomber japonicus* and *Trachurus picturatus* from the NE Atlantic off Madeira; *Euthynnus affinis*, *Scomberomorus commerson*, *Sarda orientalis* and *C. hippurus* from the west Indian Ocean off Somalia; and from *Merluccius merluccius* from the eastern Mediterranean Sea (Palm et al. 2008). Further records were provided by Mattiucci et al. (2005) from Florida, Farjallah et al. (2008) from the Mediterranean coast of North Africa (*Scomber scombrus*, *M. merluccius*, *Phycis phycis*), from Australia by Cannon (1977) and more recently by Shamsi (2007, 2014) and Jabbar et al. (2012) from the Great Barrier Reef, and by Chen & Shih (2015) from Taiwan. Kuhn et al. (2013) have already summarized the worldwide known hosts for genetically confirmed worms, naming 26 different teleost species. *A. typica* is a common parasite of various dolphin species from warmer temperate and tropical waters, belonging to the families Delphinidae, Phocoenidae and Pontoporiidae (see Mattiucci et al. 2002, Kleinertz et al. 2014a). The eggs of the congener *A. simplex* (s.s.) are expelled from their hosts with the faeces and embryonate in seawater (Klimpel & Palm 2011). Larvae hatch as free-living third-stage larvae (L3), still surrounded by the sheath of the second-stage larvae (L2), and get eaten by small crustaceans (copepods, euphausiids) as first intermediate hosts. The L3 develops inside the first intermediate host, and larger invertebrates, cephalopods and various fish species serve as transport hosts that acquire the nematodes through the food chain. They can be transferred further into larger transport hosts without moult, acquiring high numbers in these hosts (Jakob & Palm 2006). The life cycle is completed when the definitive hosts preys upon infected crustaceans, cephalopods or fishes (Kellermanns et al. 2007). The stomach of the studied *Auxis rochei rochei* by Palm et al. (2008) was filled with small crustaceans and only a few small-sized fish, and *Decapterus russelli* as a common host preyed upon small crustaceans as well. A low intensity of anisakids in a sampled fish species suggests that the larvae uptake originates directly from the crustacean first intermediate hosts (see Palm 1999), while larger predatory fish also serve as transport host and accumulate the larvae (Table 4). This suggests that several reef fish within the present study, such as *Sufflamen fraenatum*, accidentally aquire the worms, while the heavily infected pelagic scombrids, carangids and coryphaenids either are infected directly through the first intermediate or serve as transport host, suggesting a pelagic life cycle for the tropical *A. typica*, as suggested by Palm et al. (2008) and tentatively by Kuhn et al. (2013).

Anisakis typica var. *indonesiensis*

The predominant recorded genotype within the present study was *A. typica* var. *indonesiensis*, a genotype for the first time reported from *Auxis rochei rochei*, *Caesio cuning*, *Coryphaena hippurus* and *Epinephelus areolatus* from Indonesia by Palm et al. (2008). It was recently described also from Papua New Guinea (Koinari et al. 2013), Sulawesi, Java and Bali, Indonesia (Kuhn et al. 2013, Anshary et al. 2014, Kleinertz et al. 2014a) under different names, having a distinct 4 bp difference (the same range as recorded for the siblings *A. simplex* (s.s.) and *A. berlandi* as well as *A. pegreffii*). Multiple marker studies combined with morphological investigation of the adults must test whether this difference distinguishes a dis-

tinct species or is a matter of intraspecific variability. Therefore, we refrain from nominating a distinct taxon, but apply the subspecific entity *A. typica* var. *indonesiensis*. This genotype seems to be more widely spread than known so far, appearing to have no clear host specificity in Indonesian waters, infecting over 28 (of 32 with genetically identified *Anisakis* spp. infection) teleost host species belonging to 14 (of 15) families. In contrast, only 6 of these 32 infected Indonesian fish species harbour both the common *A. typica* (s.s.) as well as this genotype. A single case of an additional genotype reported by Palm et al. (2008) in *Auxis rochei*, possibly a hybrid between the 2 *A. typica* genotypes, suggests that both have the same final hosts in the region and are able to infect the same or a similar intermediate host range. Interestingly, Shamsi (2007) also suggested that the *A. typica* in Australia seems to be genetically different from those reported in other countries, and the cluster analysis of *A. typica* by Iniguez et al. (2011) showed a cluster consisting only of intermediate/paratenic hosts from Asian coasts. Adult specimens must be sampled from the final hosts in the region for a future species description, to morphologically distinguish *A. typica* var. *indonesiensis* from *A. typica* (s.s.).

Distribution of *Anisakis* spp.

A. berlandi and *A. pegreffii* are reported for the first time from an equatorial region (both have been already reported from Australian mammals, see Shamsi et al. 2012), and *A. physeteris* is recorded for the first time from the Pacific Ocean. These 3 species were exclusively found in the pelagic, oceanodromous and migratory carangid *Auxis rochei*. According to Klimpel et al. (2008), Mattiucci & Nascetti (2007, 2008) and Kellermanns (2009), *A. berlandi* and *A. pegreffii* together with *A. simplex* (s.s.) form the *A. simplex* s.l. complex of species that are most common in temperate to cold regions, e.g. from 30–70° N and S latitudes. *A. berlandi* so far has been reported from the North and South Pacific, the Atlantic coast of southern Africa, and from Australia and off New Zealand (Mattiucci et al. 1997, 2014, Mattiucci & Nascetti 2006, 2007, 2008, Klimpel et al. 2008, Kellermanns 2009), and has been found in the migrating pilot whale *Globicephala melas* (Mattiucci et al. 2014) as an adult. *A. pegreffii* infects delphinids, ziphiids, physeterids and neobalaenids as final hosts and has been reported from the waters off Italy, Argentina, Brazil, South Africa and New Zealand (Klimpel et al. 2008, Mattiucci & Nascetti 2008, Kellermanns 2009), especially in the temperate zones. Recent cases of anisakiasis caused by *A. pegreffii* in Korea (Lim et al. 2015), Italy and Japan (Mattiucci et al. 2013, Lim et al. 2015) demonstrate that besides *A. simplex* (s.s.), *A. pegreffii* can also become human-pathogenic. Interestingly, *A. simplex* (s.s.), commonly found in the northern hemisphere and also in Japan in the North Pacific, could not be identified within the present study. This is of importance because *A. simplex* is the main species causing anisakiasis. Also *A. physeteris*, infecting physeterid whales as adults, has been reported from temperate regions, e.g. the Atlantic and Mediterranean, but not yet from the Pacific Ocean. However, physeterid whales are found worldwide, also in the Pacific. Consequently, the present study sheds some light on the general distribution patterns of *Anisakis* infections in the world oceans. Though only rare findings of the above species from the low latitudes do exist, they also occur as larvae in teleosts of the tropics, and future findings are expected. Because the migrating *Auxis rochei* from Indonesia is widely distributed within the region but does not migrate into temperate zones, they must have acquired the *Anisakis* larvae from the first or second intermediate hosts around Indonesian waters. Whales as final hosts are able to release the eggs while migrating between the northern and southern hemisphere. However, in the case of *A.berlandi*, *A. pegreffii* and *A. physeteris*, the larvae seem to be able to infect also intermediate hosts in tropical waters, explaining their extensive range of distribution. This might be different for *A. simplex* (s.s.) which is restricted to the boreal zone, and especially occurs in the northern hemisphere. The species might have a more restricted first intermediate host regime. Similarly, the genotype *Anisakis* sp. HC-2005 so far has been reported from 3 different teleost hosts in Indonesia (*Sufflamen fraenatum*, present study; *Lepturacanthus savala*, Kuhn et al. 2013; and *Epinephelus areolatus*, Kleinertz et al. 2014a), and from northwest Africa (*Hoplostethus cadenati* from the African shelf, see Kijewska et al. 2009), and seems to be not able to extend the host range into the more northern and southern regions. This underlines the importance of low host-specificity to infect a range of first intermediate hosts to extend the host distribution in the anisakid nematodes, as earlier suggested by Kellermanns et al. (2007). The other factors supporting constant gene flow (see Mattiucci et al. 2002) are extensive final and intermediate host migration, overlapping distribution patterns of different final host populations,

and large population sizes in the intermediate and final hosts (Palm 2004, Kellermanns et al. 2007, Palm et al. 2007).

Infection patterns and site

Analyses of the infected teleost hosts and their ecology reveal a distinct pattern, with highest infection rates in the scombrids and carangids and lowest in some reef-associated fish (cf. Tables 1 & 2). We did not expect differences during the rainy versus dry seasons, because the worms are quite long-living. The fact that 94% of the worms were sampled throughout the dry seasons is a result of uneven distribution in the fishes, because 667 worms (of all 848) were isolated from a sample of 36 *Auxis rochei* during the dry season only (cf. Tables 1 & 2). The observed prevalence and the intensity of infection of *Anisakis* spp. were highest in the pelagic schooling scombrid *Auxis rochei*, also getting infected with 5 of the 6 detected *Anisakis* taxa. This leads to the assumption that this fish species is the most suitable intermediate host for *Anisakis* nematodes in the sampled region. *A. typica* (s.l.) infections of *Auxis rochei rochei* are readily observed throughout the years, especially between 2005 and 2006 (Palm et al. 2008) and 2013 (present study), with a minimum prevalence of 20%. This complies with the presence of the potential final hosts in the region. Other high infection rates within this study were observed in the oceanic/pelagic/schooling *Auxis thazard*, *Selar crumenophthalmus* and *Decapterus tabl*, the benthopelagic *Trichiurus lepturus* and also in the more reef-associated *Epinephelus areolatus* and *Caesio cuning* (cf. Tables 2–4) and *Priacanthus tayenus*. This might refer to the distribution of the dolphin final hosts in the region that migrate throughout the archipelago but also close to coral reef habitats, and may also feed on schooling demersal fish over shallow sandy bottoms (compared to the high prevalence of infection in *Terapon jarbua*). Consequently, the occurrence in reef-associated fish does not refer to a benthic parasite life cycle but to the wide distribution of the suitable first intermediate hosts (offshore to close to the reef ecosystems), low host-specificity concerning the teleost hosts (hundreds of possible intermediate fish host species), and to the mobility of the dolphin final hosts between the different tropical habitats and food webs. This possibly overcomes the limitations of the otherwise highly specialized food web in coral reef habitats, enabling *Anisakis* to infect such a wide host range.

The typical infection site for Indonesian *Anisakis* spp. was the body cavity, with n = 131 free-living worms, and others attached to the mesenteries and outer surfaces of the liver (n = 299), gonads (n = 138), stomach (n = 136) and guts (intestine, n = 95; pyloric caeca, n = 45). Because most of the recorded *Anisakis* belonged to *A. typica* and *A. typica* var. *indonesiensis*, these are the preferred infection sites for these 2 genotypes. Previous studies reported no muscular infections (Burhanuddin & Djamali 1978, 1983, Ilahude et al. 1978), Palm et al. (2008) found only a single case in 110 examined *Auxis rochei*, Anshary et al. (2014) stated possible migration into the musculature, and the present study documented a single specimen from the musculature of *Selar crumenophthalmus*. In contrast, the related *A. simplex* (s.s.) that is known as a main cause of zoonotic anisakiasis often infects fish musculature in temperate waters (e.g. Strømnes & Andersen 1998, 2003). Palm et al. (2008) suggested that besides the life cycle and dispersal mechanism, a typical site of infection might be another distinguishing feature among the different *Anisakis* taxa. This can explain why *A. typica* (s.l.) so far has not been affiliated with human anisakiasis, and no case of anisakiasis from Bali has been recorded (also see Palm et al. 2008). However, this contradicts Uga et al. (1996), who found *Anisakis* antibodies in a number of Javanese people. The only explanation is that though the most common *A. typica* (s.l.) are regularly taken up and become digested by consumers, they seem to cause no major infection with serious disease symptoms. This suggests a general low risk of Indonesian fisheries consumers to develop anisakiasis. While the most dangerous *A. simplex* (s.s.) could not be recorded from Indonesia, we isolated only a single *A. pegreffii* from an *Auxis rochei*, which is nowadays known to cause anisakiasis (3 cases worldwide). However, it is not clear which *Anisakis* species caused the immunological reaction identified by Uga et al. (1996).

Outlook

There are 3 main outcomes for future studies. First, we recommend sampling adults of *A. typica* var. *indonesiensis* for a morphological species description in future. This can be done either by dissecting stranded marine mammals or via an underwater sampling while diving with dolphins, wild or trained for animal health monitoring purposes. Kleinertz et al. (2014b) demonstrated the functionality of the lat-

ter. Second, until a new species description and taxonomical treatment has been completed, we strongly recommend the name *A. typica* var. *indonesiensis* when dealing with this Indonesian taxon or its genotype, because this genotype has been documented as the predominant one in Indonesia. It also cannot be excluded that it will be reported from other tropical regions outside Indonesia in future. Third, taking into account various *Anisakis* species in a broad range of fish host species, the transfer of northern and southern species via migratory hosts into the region, and positive tests for *Anisakis* antibodies of Indonesian citizens as well as the documentation of the human-pathogenic species *A. pegreffii*, we suggest seroepidemiological or stereoscopical tests of Indonesian citizens. Although presumably at a low risk, additional insights into the real anisakiasis impact in Indonesia, the 4th most populous nation of the world with almost every citizen reliant on ocean and fisheries supplies, but also with a low standard in the medical system, are still required. Consumers should thus be informed that the scombrid *Auxis rochei* bears the highest risk of anisakiasis infection in Indonesia, and should not be used in dishes using raw or semi-cooked fish.

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RESEARCH ARTICLE

Pseudempleurosoma haywardi sp. nov. (Monogenea: Ancyrocephalidae (*sensu lato*) Bychowsky & Nagibina, 1968): An endoparasite of croakers (Teleostei: Sciaenidae) from Indonesia

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Abstract

An endoparasitic monogenean was identified for the first time from Indonesia. The oesophagus and anterior stomach of the croakers *Nibea soldado* (Lacépède) and *Otolithes ruber* (Bloch & Schneider) (n = 35 each) sampled from the South Java coast in May 2011 and *Johnius amblycephalus* (Bleeker) (n = 2) (all Sciaenidae) from Kedonganan fish market, South Bali coast, in November 2016, were infected with *Pseudempleurosoma haywardi* sp. nov. Prevalences in the first two croakers were 63% and 46%, respectively, and the two *J. amblycephalus* harboured three and five individuals. All three croakers represent new hosts for this monogenean genus. We provide infection rates, light microscopical observations, 3D confocal microscopical illustrations, and a morphometric comparison with all congeners. The new species differs in body size, the position and shape of the ovary and testes, and especially in the composition of the dorsal anchor complex, with the dorsal bar being anteriorly concave rather than planar or convex as in its congeners. The dorsal and ventral anchors of this new species are the longest in the genus, whereas the male copulatory organ is the smallest. The first DNA sequences for a member of this genus demonstrate the greatest similarity with endoparasitic freshwater monogeneans from African cichlid fishes. This suggests a freshwater origin for these marine endoparasitic monogeneans.

Introduction

The Monogenea are common ectoparasitic flatworms of fish, usually infecting gills, fins and scales, but also the eyes and nostrils. They feed on blood, mucus or epithelial cells of their host. The group is highly diverse, with an estimated 25,000, usually highly host specific, species. Besides the unique haptor (posterior attachment apparatus), the monoxenous life cycle is a typical feature which contrast to other platyhelmiths. The adults are hermaphroditic and

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reproduce sexually, with eggs releasing ciliated oncomiracidiae larvae; these seek a fish host, mainly photo- and chemotactically, and develop into adults. The combination of a direct life cycle, high host specificity and the adverse effects due to feeding on fish inducing possible secondary bacterial or viral infections often leads to mass infections in finfish aquaculture. They have resulted in disastrous financial losses worldwide (e.g. in commercially important grouper, barramundi, amberjack and salmon farms) [1,2].

Very few monogeneans are endoparasitic, i.e. found inside the host's body. Occasionally species infect the digestive tract, heart musculature or blood vessels [3]. Species belonging to the genus *Pseudempleurosoma* Yamaguti, 1965 exhibit such a specialization in terms of their infection site that they have adapted to an endoparasitic life, showing different adaptation levels [4], especially in the anchor apparatus, to attach to the oesophageal folds [5]. This type of adaptation is known in only a few genera, such as in the '*Diplectanotrema*-group´, parasitizing the foregut–pharynx, oesophagus and stomach–and rectum of marine fishes, e.g. *Diplectanotrema* Johnson and Tiegs, 1922, *Neodiplectanotrema* Gerasev, Gaevskaja & Kovaleva, 1987, *Paradiplectanotrema* Gerasev, Gaevskaja & Kovaleva, 1987, *Pseudodiplectanotrema* Gerasev, Gaevskaja & Kovaleva, 1987 and *Metadiplectanotrema* Gerasev, Gaevskaja & Kovaleva, 1987 [5]. Additionally, this adaptation is present in monogeneans of the genus *Enterogyrus* Paperna, 1963, with species that inhabit the stomach of freshwater fishes [6,7], and in *Montchadskyella* Bychowsky, Korotajeva & Nagibina, 1970 (Montchadskyellidae, also marine, but pseudosegmented in contrast to the '*Diplectanotrema*-group´) [8]. This leads to the assumption that evolution to an endoparasitic lifestyle happened multiple times in monogenean history. Rarely the urinary bladder of fishes can be parasitized, and even freshwater amphibians and turtles are utilized as hosts (by the genera *Polystoma* (Frölich, 1791) and *Kritskyia* Kohn, 1990, respectively). One out of the thousands of species, namely *Oculotrema hippopotami* Stunkard, 1924 infects the eyes of the hippopotamus (the only known monogenean ectoparasite of mammals) [9–11].

The genus *Pseudempleurosoma* Yamaguti, 1965 was first described for the type species, *P. carangis* Yamaguti, 1965, from the hosts *Caranx lugubris* Poey, 1861, *Caranx sexfasciatus* Quoy & Gaimard, 1825 (both Carangidae) and *Myripristis berndti* Jordan & Evermann, 1903 (Holocentridae) from Hawaiian waters (Pacific Ocean) [4]. While monogeneans in general are considered highly host specific, *Pseudempleurosoma* is not, infecting different host species, genera and families. After a re-examination of the holotypes and paratypes of the type species of the genus, which differs from *Metadiplectanotrema* by the presence of two rather than one ventral bars associated with each ventral anchor, and by the presence of an accessory piece around the male copulatory organ (MCO). *Metadiplectanotrema* was considered a junior synonym of *Pseudempleurosoma* [6]. So far, four further species (*P. caranxi* (Gerasev, Gaevskaja & Kovaleva, 1987) Santos, Mourão & Cardenas, 2001, *P. myripristi* (Gerasev, Gaevskaja & Kovaleva, 1987) Santos, Mourão & Cardenas, 2001, *P. gibsoni* Santos, Mourão & Cardenas, 2001 and *P. guanabarensis* Carvalho & Luque, 2012) have been described from the Atlantic Ocean, with the additional hosts *Caranx ruber* (Bloch, 1793), *Myripristis jacobus* Cuvier, 1829 (Carangidae resp. Holocentridae), *Paralonchurus brasiliensis* (Steindachner, 1875) (Sciaenidae), *Rachycentron canadum* (L., 1766) (Rachycentridae), *Sphoeroides testudineus* (L., 1758) (Tetraodontidae) and *Trichiurus lepturus* L., 1758 (Trichiuridae) between 1987 and 2012 [5–6,12–13]. All recorded fish host species, except the tetraodontid pufferfish, have an economic value and show similarities in their ecology.

No DNA sequence for members if this group is known, but analyses of phylogenetic relations within the Dactylogyridae, including freshwater endoparasitic taxa, have been provided [14]. It has already been mentioned that endoparasitic monogeneans were dispersed from an origin in freshwater fish with their hosts potentially crossing to the marine environment, while

the original ectoparasitic fauna was lost during this migration. It is thought that ectoparasites are not able to tolerate the variation in salinity and osmolarity [14]. For the first time, we now compare sequences of a new marine endoparasitic member of the '*Diplectanotrema*-group', *Pseudempleurosoma haywardi* sp. nov., with a detailed phylogenetic analysis of most related dactylogyrid taxa, including *Enterogyrus*. We support the hypothesis that marine endoparasitism in monogeneans originates from African freshwater endoparasitic species, and we secure the phylogenetic position of these marine endoparasites. The monogenean species described herein represents a new member within the genus *Pseudempleurosoma*, and is the first species of this genus described from the Indian Ocean. A detailed description using 3D confocal microscopy and a morphometrical comparison between the valid species within this genus are provided.

Materials and methods

Sample collection and processing

The sciaenid croakers *Nibea soldado* and *Otolithes ruber* (n = 35 each) were sampled from Cilacap fish market, South Java coast, Indonesia (7˚43´25.0´´S 109˚01´22.7´´E) in May 2011, and an additional small sample of the sciaenid croaker *Johnius amblycephalus* (Bleeker, 1855) (n = 2) was obtained from Kedonganan fish market, South Bali coast, Indonesia (8˚45´25.60´´S 115˚10´05.94´´E) in November 2016. The fishes were transferred on ice to the Parasitological and Entomological Laboratory, Biological Faculty, Universitas Jenderal Soedirman (UNSOED University), Purwokerto, Java, and to the Marine and Fisheries Faculty Laboratory, Udayana University (UNUD), Kampus Bukit, Jimbaran, Bali, Indonesia, respectively.

Morphometrical data for each fish were taken (total and standard length (TL and SL) to the nearest 0.1 cm, total and gutted weight (TW and GW) to the nearest 0.1 g). The body cavity was opened and studied by naked eye. The internal organs were transferred to Petri dishes containing NaCl solution (0.9%), and studied for parasites under a Zeiss Stemi DV4 binocular microscope. The endoparasitic monogenean parasites were isolated from the oesophagus/proximal stomach, washed in saline solution and roughly identified under a Novel XSZ-107BN microscope. Some worms were compressed and directly transferred to 95% ethanol for confocal laser scanning microscopy, some worms from each of the three host fish species were directly transferred to 99.8% EtOH for DNA analyses. Most ancyrocephalids were fixed using AFA (Alcohol: Formalin: Acetic acid) or 4% neutral buffered formaldehyde, and then transferred and stored in 70% EtOH for further morphological analyses (light microscopy). Type-specimens are deposited in the Berlin Natural History Museum (ZMB, catalogue Entozoa, holotype: E.7602, paratypes E.7603a-h and E.7604a-i for specimens from additional host) and in the Bogor Zoological Museum, Bogor, Java, Indonesia (paratypes MZBTr 230 (from type host) and MZBTr 231 (from additional host)). The ecological parameters for fish infections with *Pseudempleurosoma haywardi* sp. nov. (prevalence, intensity and abundance) were calculated according to standards [15].

Light microscopy, drawing and morphological investigation

Fixed specimens were cleared and mounted with glycerin following standard parasitological methods [16]. Some whole mounts were also prepared with compressed samples from 70% ethanol and stained with acetic carmine to study the sclerotized hard-parts. Measurements (in micrometres) are according to the initial generic description [4] (red arrow in Fig 1), and are given as the range followed by the mean in parentheses. Illustrations were prepared with the aid of a camera lucida drawing tube. Images were taken with a digital camera (Olympus

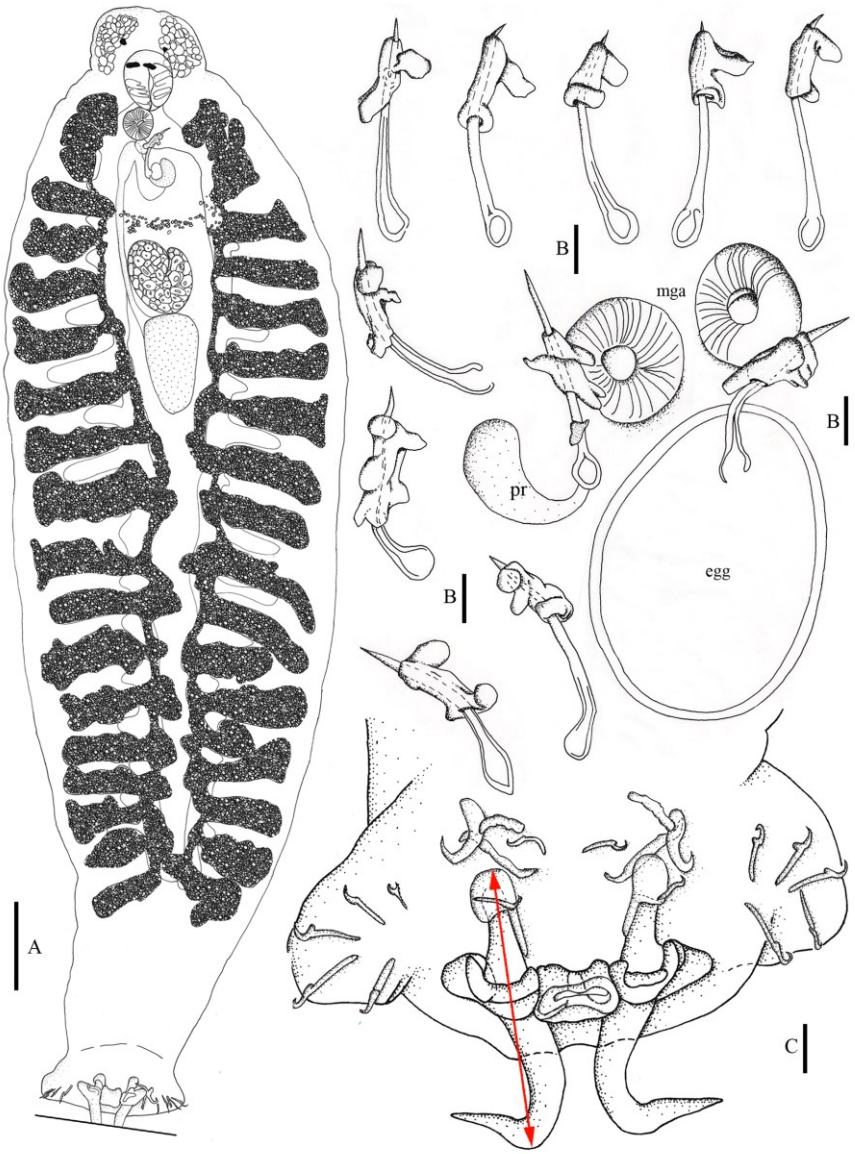

Fig 1. Drawings of *Pseudempleurosoma haywardi* sp. nov. Holotype in ventral view from *Nibea soldado* (**A**), male copulatory organs (MCO) drawings of different *Pseudempleurosoma haywardi* sp. nov. individuals from the fish hosts *Otolithes ruber* (upper row of five MCOs) and *Nibea soldado* (6×), partially shown with position of muscular genital atrium/disc (mga), egg and prostatic reservoir (pr) (**B**) and of the opisthaptor with anchors, bars and seven pairs of hooks (the red arrow defines measuring) (**C**); scale bars **A**: 50 μm; **B** & **C**: 10 μm.

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UC30) attached to an Olympus BX53 light microscope, and measurements recorded with Olympus Cellsens Dimension software, Soft Imaging Solutions GmbH.

Confocal microscopy

Several 95% ethanol-fixed specimens were processed for confocal laser scanning microscopy following standard procedures [17–18], using a Leica TCS SP2 confocal microscope equipped with an inverted Leica DMIRE2 microscope and a PL APO 363 oil immersion objective (numerical aperture 5 1.4, z section setting minimum 200) at the Live Cell Imaging Center, Department of Biology, University of Rostock.

DNA analysis

For molecular analysis, genomic DNA was extracted from several adult worms of all three fish host species fixed in 99.8% ethanol following a recent useful protocol [18], i.e. grinding whole worms and using the suspension as a template directly without DNA extraction. Amplification of D1-D3 fragments of the large subunit region (LSU) was achieved using the following primers: C1 (forward; `5′-ACCCGCTGAATTTAAGCAT-3′`) and D2 (reverse; `5′-TGGTCCGTGTTTCAAGAC-3′`) [14]. The reaction was performed using illustra™ puReTaq Ready-To-Go PCR beads (0.2 ml tubes, 96 reactions), containing 5 pmol of each primer, 5 μl of DNA suspension and nuclease free water to a total volume of 30 μl. Obtained PCR products (1 μl) were viewed on a 0.8% agarose gel stained with ethidium bromide. Contiguous sequences were aligned and assembled using BioEdit v.7.0.9 [19]. The generated sequences (GenBank accession numbers (GBAN) MF115714-MF115717) were aligned with their closest matches in GenBank (23 in-group and *Actinocleidus recurvatus* (GBAN AJ969951) as an outgroup taxa). Phylogenetic analyses were performed in MEGA version 7 [20] based on the best scoring model (Bayesian Information Criterion, see supporting information S1 Calculation, https://figshare.com/s/75cc37ed9297dc11d983), maximum likelihood was used for the best fitting tree according the General Time Reversible Model, rates among sites were gamma distributed with invariant sites (G + I), the number of discrete gamma categories was 5, and using complete deletion of gaps as gaps missing data treatment. The robustness of the inferred phylogeny was assessed using a bootstrap procedure with 1,000 replications [21].

Ethic statement

In this study, experiments were not performed on live vertebrates. Instead, freshly caught dead fish was used and therefore no ethics statement is required. Samples were taken within the Indonesian German joint research cooperation "SPICE" (Science for the Protection of Indonesian Marine Coastal Ecosystems), a German Indonesian initiative in earth system research, with research permit from RISTEK, the Indonesian State Ministry of Research and Technology, and in cooperation with Udayana University, Denpasar, Bali. The fishes were obtained from official fish markets (see Material and Methods section), national laws regulate captures and fishermen/salesmen are licensed, sampled fish species are common in Indonesia, not protected, and the number of 35 individuals per species was sampled because it is a good estimate to analyze the entire parasite community of a given fish species at a given location, and 35 is a minimum number for statistical tests.

Nomenclatural acts

The description of *Pseudempleurosoma haywardi* **sp. nov.** (LSID species identifier number: urn:lsid:zoobank.org:act:828053D6-3445-4BF5-BEEA-71F60411DF6D) complies with the

requirements of the International Commission on Zoological Nomenclature (ICZN). The electronic edition of this article conforms to the requirements of the amended International Code of Zoological Nomenclature, and hence the new names contained herein are available under that Code from the electronic edition of this article. This published work and the nomenclatural acts it contains have been registered in ZooBank, the online registration system for the ICZN. The ZooBank LSIDs (Life Science Identifiers) can be resolved and the associated information viewed through any standard web browser by appending the LSID to the prefix "http://zoobank.org/". The LSID for this publication is: urn:lsid:zoobank.org:pub:330FC71D-07AC-49A8-B5C2-06BE39667B0B. The electronic edition of this work was published in a journal with an ISSN, and has been archived and is available from the following digital repositories: PubMed Central, LOCKSS and ResearchGate. DNA sequences are available in GenBank under the GBAN MF115714-MF115717.

Results

Taxonomy and description

Family Ancyrocephalidae (*sensu lato*) Bychowsky & Nagibina, 1968

Pseudempleurosoma Yamaguti, 1965

Syn. *Metadiplectanotrema* Gerasev, Gaevskaja & Kovaleva, 1987 ([6])

Pseudempleurosoma haywardi **sp. nov.**

urn:lsid:zoobank.org:pub:330FC71D-07AC-49A8-B5C2-06BE39667B0B

Type-host: soldier croaker, *Nibea soldado* (Lacépède, 1802) (Sciaenidae)

Additional hosts: tigertooth croaker, *Otolithes ruber* (Bloch & Schneider, 1801) (from type-locality) and bearded croaker, *Johnius amblycephalus* (Bleeker, 1855) (from additional locality) (both Sciaenidae)

Type-locality: Cilacap, South Java coast, Indonesia (7˚43´25.0´´S 109˚01´22.7´´E)

Additional locality: Kedonganan, South Bali coast, Indonesia (8˚45´25.60´´S 115˚10´05.94´´E)

Habitat: oesophagus/proximal stomach

Type-material: holotype E.7602; paratypes E7603a-h (and additional specimens from additional host E7604a-I), and additional paratypes MZBTr 230 and MZBTr 231 (latter from additional host).

Deposition of specimens: Berlin Natural History Museum, Germany ("Museum für Naturkunde") (holotype E.7602; paratypes E7603a-h and additional specimens from additional host E7604a-I), and Bogor Zoological Museum ("Museum Zoologicum Bogoriense"), Indonesia (paratypes MZBTr 230 and specimens from additional host MZBTr 231).

Infection: 22 of 35 fish (*N. soldado*) harboured 65 specimens and 16 of 35 fish (*O. ruber*) examined harboured 32 specimens. Prevalence 63% (*N. soldado*) and 46% (*O. ruber*), mean intensity 3 (*N. soldado*) and 2 (*O. ruber*), intensity 1–7 (*N. soldado*) and 1–6 (*O. ruber*), mean abundance 2 (*N. soldado*) and 1 (*O. ruber*). The two *J. amblycephalus* from Bali were infected with three and five individuals respectively.

Etymology: the specific name is for Dr. Craig J. Hayward who recorded the first unidentified *Pseudempleurosoma* nearby Indonesian waters in 1997.

Description (all measurements in μm) (Figs 1 and 2): based on 12 specimens from the type host *N. soldado* (see also supporting information S1 and S2 Tables and S1 Fig for details, https://figshare.com/s/75cc37ed9297dc11d983).

Body slender, unspined, 588–1295 (971) long; maximum width 181–361 (289) (at level of boarder ovary/testis). Single pair of head glands extends to pharyngeal region. Two pairs of eye-spots. Oral aperture ventral; pharynx globular, 40–67 × 40–63 (52 × 48) (length × width) (Fig 1A). Intestinal caeca overlaid posterior to testis, coexisting with vitelline follicles, with

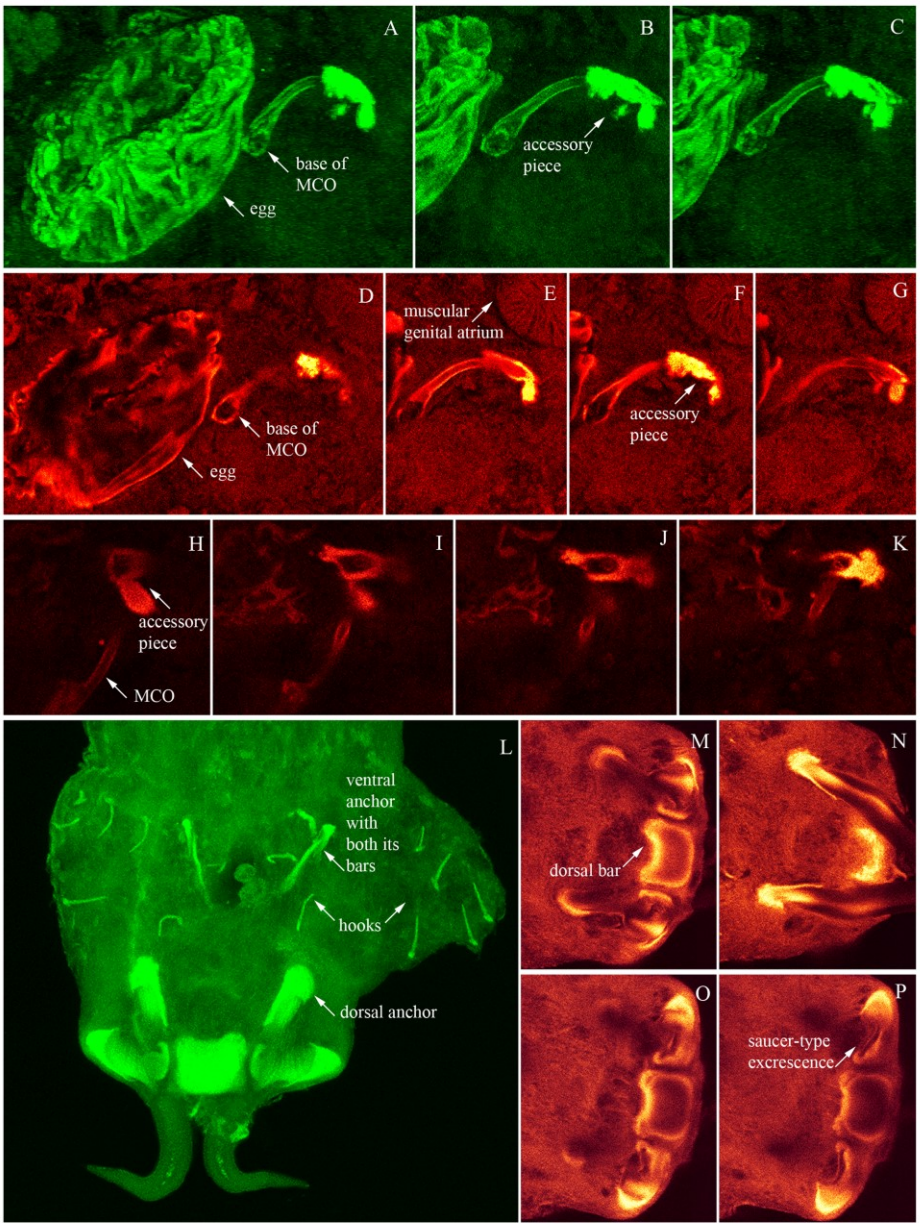
A
base of MCO
egg
B
accessory piece
C
D
base of MCO
egg
E
muscular genital atrium
F
accessory piece
G
H
accessory piece
MCO
I
J
K
L
ventral anchor with both its bars
hooks
dorsal anchor
M
dorsal bar
N
O
P
saucer-type excrescence

Fig 2. Confocal photos of *Pseudempleurosoma haywardi* sp. nov. Confocal microscopy illustrations of male copulatory organ (MCO) of *Pseudempleurosoma haywardi* sp. nov. with accessory pieces (**A-K**), from different angles (**A-C**), at different levels (**D-G**) and from a second worm (**H-K**), and of the opisthaptor with its hooks, anchors and bars (dorsal bar concave anterior) (**L**) as well as from different levels of the dorsal anchor apparatus (outer root extension with chitin containing cap, inner root extension with saucer-type excrescence) (**M-P**); additional confocal photos are shown in the supporting information S1 Fig, https://figshare.com/s/75cc37ed9297dc11d983.

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lateral diverticula lacking haematin pigment. Haptor, 53–84 × 101–142 (66 × 116) length × width), not distinctly set off from body, but laterally lobed; with 2 pairs of dissimilar anchors and 14 marginal hooks (Figs 1A, 1C and 2L). Dorsal anchors, measured according to genus original description [4] from tip of ventral root to height of curve of blade (with inner dorsal root being shorter than outer ventral root in this genus), comparatively long (longest in genus), 59–61 (60) in length, connected by single quadrangular dorsal bar with distinct concave anterior border, 12–21 (19) from end to end, with distance of 12–17 (15) from anterior to posterior border (Figs 1C and 2L–2P). Ventral anchors 14–16 (15) in length, each one with two bars: one attached of 8–18 (11) in length and one free irregular bar of 17–21 (19) in length (Figs 1C and 2L). Marginal hooks 13–16 (15) long (Figs 1C and 2L). Male copulatory organ (MCO) sclerotized, tubular, 29–51 (42) long, with seminal vesicle and prostatic reservoir at base; accessory piece sclerotized, irregular in shape, 14–23 (20) long (Figs 1B and 2A–2K). Testis post-ovarian, oval to almost triangular, widest at its anterior region, 39–95 × 26–57 (76 × 41) (length × width) (Fig 1A). Ovary turned back on itself, giving appearance of being oval, 44–101 × 32–74 (77 × 55) (length × width) (Fig 1A). Uterus sacciform, ends as muscular aperture of 21–39 × 20–31 (29 × 25) (length × width), in smooth genital atrium, almost round in shape (Fig 1A and 1B). Vagina simple, opens at level of muscular genital atrium, no sclerotization visible even in laser confocal microscopy. Vitelline follicles arranged longitudinally in lateral fields along body (Fig 1A). Vitelline ducts unite in a slender line half way between the base of MCO and ovary. Eggs oviform, 56–72 × 39–59 (67 × 50) (length × width), polar filament absent (Figs 1B and 2A).

Remarks

Due to the presence of i) an accessory piece on the MCO and ii) two bars associated with each ventral anchor, as well as iii) one bar connecting the two dorsal anchors, the new species belongs to *Pseudempleurosoma* (see Table 1 and [6]). The specimens from all sampled fish species belong to the same species (Table 2 and in more detail in the additional supporting information S1 Table and S2 Table), and thus measurements of *P. haywardi* sp. nov. from both host species sampled in higher number (n = 35, see Material and Methods section,) are combined for the following comparison with its congeners (based on 12 specimens from the type host *N. soldado* and 11 specimens from the additional host *O. ruber*).

The body length of *Pseudempleurosoma haywardi* sp. nov. is in the range of the body length of *P. carangis* and *P. myripristi*; *P. gibsoni* is slightly longer; *P. caranxi* is much longer; and *P. guanabarensis* has almost the double body length (see Table 2). The body width of *P. haywardi* sp. nov. is similar to the body width of *P. carangis* and *P. gibsoni*; the body of *P. myripristi* is–even though the length is similar to the new species–much wider. The two longer species *P. caranxi* and *P. guanabarensis* have wider bodies (Table 2). The detached bars of the ventral anchors have similar sizes compared to the congeners', except *P. guanabarensis*, which has smaller detached bars than all other congeners (Table 2). The size of the marginal hooks is similar in all species of this genus (Table 2). Compared to *P. haywardi* sp. nov., the sizes of the eggs are larger in all congeners except in *P. caranxi*, which shows similar egg sizes (Table 2).

Table 1. Key characteristics of the genera within the "*Diplectanotrema*-group."

Genus	Accessory piece on MCO	Ventral anchors with bars
Diplectanotrema	Yes	No
Neodiplectanotrema	No	Yes, with one shared
Paradiplectanotrema	Yes	Yes, with one each
Pseudodiplectanotrema	No	No
*Pseudempleurosoma**	Yes	Yes, with two each**

*Synonym: *Metadiplectanotrema* [6]

**One bar was stated in the initial generic description [4], but re-examination [6] showed that there are two bars, and "anterior pair of hooklets [= hooks (authors)] large" [4] probably means the second ventral bars. Another interpretation stated no bar within the documentation of a single South East Asian individual [22] (see Discussion); MCO: male copulatory organ

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Besides these differences, *P. haywardi* sp. nov. differs from all congeners by having longer dorsal anchors. With a length of 58–64 (60), they are the by far longest in the genus. The other five valid species have dorsal anchor length range of 38–58, and mean values of 46–52. Thus, the dorsal anchor length alone is a strong characteristic to distinguish *P. haywardi* sp. nov. from its congeners. A second unique characteristic of the new species is the shape of the dorsal bar being anteriorly concave, while all so far described dorsal bars of the congeners are either planar [5] or convex [4,6,12]. Thus, the two structures of the dorsal anchor complex, namely the dorsal anchors and the dorsal bar of *P. haywardi* sp. nov., are unique. Also the ventral anchor is the longest in this new species. With sizes of 14–18 (16), it differs from its congeners with only 10–15 (mean around 12). The range of the length of the attached ventral bar of the congeners is similar to the sizes of our material, however, with up to 18, the attached ventral bars of *P. haywardi* sp. nov. are also the largest within the genus. In contrast, the male copulatory organ (MCO) is the smallest in the new species, with a mean value of 44, while the other species have mean values of MCO length of 50–59.

Confocal microscopy made it possible to position structures for measuring, providing a range of viewing angles for exact images and measurements, for example a dorsal view on the dorsal bar, as well as focusing through the layers of the dorsal bar from a dorsal view, showing its length and shape accurately.

Other differences from the congeners are the host species, even though a sciaenid host of *Pseudempleurosoma* was already published from the Atlantic (and for a misidentified taxa from Vietnam, probably representing *Pseudempleurosoma*, see Discussion), and the geographic range in Indonesia, South-East Asia.

DNA analysis

Following a recent protocol [18], we could not amplify the DNA of the worms sampled in 2011, however, analysis of three adult worms collected in 2016 from the bearded croaker *Johnius amblycephalus* led to sequences. The partial LSU rDNA sequences were 840bp long (with primers). A NCBI Genbank blast showed closest similarity to freshwater endoparasitic monogeneans, namely *Enterogyrus coronatus*, *Enterogyrus* "sp. 1 AS-2010" and *Enterogyrus* sp. "2 AS-2010" (GBAN: HQ010032, HQ010031, HQ010030). The new sequence is available under the GBAN MF115714-MF115717. The obtained sequence of *Pseudempleurosoma haywardi* sp. nov. formed a well supported clade with the freshwater endoparasitic Monogenea from cichlid teleosts with a strong bootstrap value of 93% (Fig 3).

Table 2. Comparative linear measures for *Pseudempleurosoma* spp.

SPECIES/ REFERENCE / MEASUREMENTS (all µm)	*P. carangis* [4]	*P. caranxi* [5,6]	*P. myripristi* [5,6]	*P. gibsoni* [6]	*P. guanabarensis* [12]	*P. haywardi* sp. nov., present study, from *Nibea soldado* (type-host)	*P. haywardi* sp. nov., present study, from *Otolithes ruber* (additional host)
Body (length x width)	800–1,320 x 150–340	1,440–1,630 x 310–440 (1,550 x 410)	590–1,250 x 220–860 (1,080 x 410)	950–1,540 x 161–308 (1,228 x 222)	1,350–2,750 x 425–850 (2,098 x 690)	588–1,295 x 181–361 (971 x 289)	582–937 x 161–305 (757 x 230)
Opisthaptor (length x width)	70–90 (width only)				68–138 x 70–185 (93 x 125)	53–84 x 101–142 (66 x 116)	58–88 x 87–137 (71 x 119)
Pharynx (length x width)					65–160 x 35–160 (120 x 119)	40–67 x 40–63 (52 x 48)	44–64 x 42–55 (53 x 47)
Ovary (length x width)				46–92 x 46–82 (68 x 70)	80–170 x 75–200 (140 x 167)	44–101 x 32–74 (77 x 55)	40–64 x 28–62 (52 x 39)
Testis (length x width)				36–65 x 27–51 (47 x 33)	90–235 x 60–165 (142 x 119)	39–95 x 26–57 (76 x 41)	45–68 x 29–47 (56 x 34)
Dorsal anchor	47–53	43?-broken	46–55 (48)	41–58 (46)	38–58 (52)	59–61 (60)	58–64 (61)
Dorsal bar (length x width)	12.5–15 (length only)	17 x 17.5	21.5 x 18	12–16 x 14–18 (14 x 16)	23–28 x 10–18 (25 x 13)	12–21 x 12–17 (19 x 15)	19–20 x 12–17 (20 x 15)
Ventral anchor	10–15	12.5	11–12.5 (12)	12–14 (12)	10–14 (12)	14–16 (15)	14–18 (16)
Attached ventral bar	15	17	11–15 (14)	12–16 (14)	5–10 (7)	8–18 (11)	10–16 (13)
Detached ventral bar		17.5	12–22 (18)	14–23 (17)	8–13 (11)	17–21 (19)	13–20 (17)
Marginal hooks (14 pcs)	10–15	12.5–15 (14)	12.5	14–18 (15)	8–15 (12)	13–16 (15)	13–16 (15)
Male copulatory organ (MCO)	50 twisted	49–55 (52) x 1.5	53–58 (56) x 2.0	43–62 (51)	45–70 (59)	29–51 (42)	33–52 (45)
Accessory piece of MCO					18–40 (29)	14–23 (20)	15–19 (17)
Muscular genital atrium (length x width)	21–27 x 23–25	Present	Present	18–30 x 23–27 (24 x 24)	170–290 (207) (from anterior end)	21–39 x 20–31 (29 x 25)	20–26 x 17–24 (22 x 20)
Egg (length x width)	90 x 70	66 x 55	87.5 x 73	78–110 x 58–97 (92 x 78)	75–100 (90) x 40–75	56–72 x 39–59 (67 x 50)	49–78 x 33–59 (68 x 50)
Filament	Absent	Absent	37	7–9 (8)	Absent	Absent	Absent
Hosts	*Caranx lugubris*, *C. sexfasciatus*, *Myripristis berndti* (& *Sphoeroides testudineus* by [13]) (Carangidae, Holocentridae (& Tetraodontidae))	*Caranx ruber* (Carangidae)	*Myripristis jacobus* (Holocentridae)	*Paralonchurus brasiliensis*, *Rachycentron canadum* (Sciaenidae, Rachycentridae)	*Trichiurus lepturus* (Trichiuridae)	*Nibea soldado* (Sciaenidae)	*Otolithes ruber** (Sciaenidae)
Geographical area	Pacific: Off Hawaii (& Atlantic: East Mexico)	Atlantic: Off Cuba	Atlantic: Off Cuba	Atlantic: Off Brazil and East Mexico	Atlantic: Off Brazil	Pacific: Off South Central Java, Indonesia	Pacific: Off South Central Java, Indonesia

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Discussion

Zoogeography and host range

A summary of the zoogeographical distribution of *Pseudempleurosoma*, ranging from the Gulf of Mexico (*P. carangis* [13]) and the Caribbean Sea (*P. caranxi* and *P. myripristi* [5]) to the

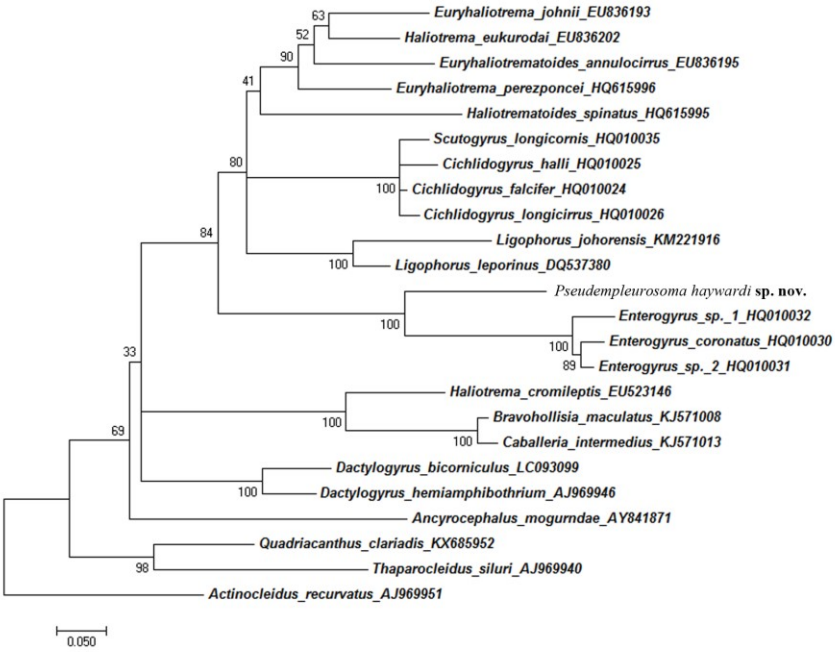

Fig 3. Maximum likelihood tree inferred from the analysis of LSU rDNA. The generated sequences were aligned with their closest matches in GenBank (23 ingroup and *Actinocleidus recurvatus* as an outgroup taxa). Phylogenetic analysis based on General Time Reversible Model with complete deletion used as gaps missing data treatment. The robustness was assessed using a bootstrap procedure with 1,000 replications [20–21]. For sequence details, see S1 Calculation (calculation of best scoring model for phylogeny studies) and S2 Fig (alignment of sequences), https://figshare.com/s/75cc37ed9297dc11d983.

https://doi.org/10.1371/journal.pone.0184376.g003

South East coast of Brazil (*P. gibsoni* and *P. guanabarensis* [6,12]), waters off Mozambique [23], the eastern Malaysian Peninsula (unidentified *Pseudempleurosoma* spp. [22,23]), the South Java coast, Indonesia (*P. haywardi* sp. nov.), Coral Sea [24] and Vietnam (misidentified

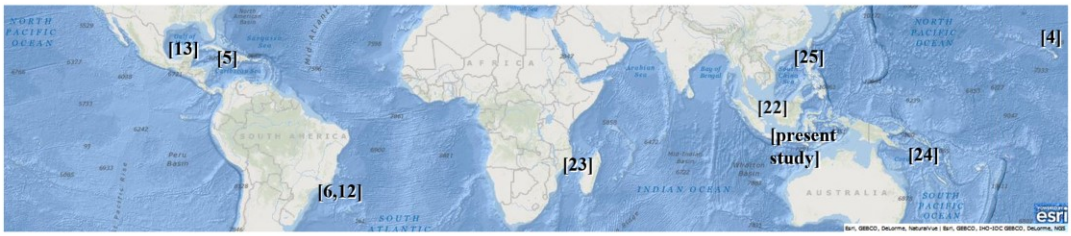

Fig 4. Biogeography of *Pseudempleurosoma* spp. All records of the genus are shown together with the reference, based on English, Russian, Vietnamese and German literature. The record from the Coral Sea [24] is doubtful (see Discussion below) and the record from Vietnam [25] is considered as *Pseudempleurosoma* (see Discussion). Reprinted with permission from Esri Inc. (Environmental System Research Institute) under a CC BY license, original copyright 2017 (see supporting information S1 Permission to use Fig 4), https://figshare.com/s/75cc37ed9297dc11d983.

https://doi.org/10.1371/journal.pone.0184376.g004

Pseudempleurosoma sp. [25]) to Hawaii (*P. carangis* [4]) is given in Fig 4. The record from the Chesterfield Islands, Coral Sea (unidentified *Pseudempleurosoma* sp. from a hoplichthyid fish [24]), is doubtful (see Fig 4 and Discussion below).

Monogeneans are known being host specific, site selecting and well adapted to their hosts [2,6], but so far members of *Pseudempleurosoma* seem to have a wide host range. The genus has been reported from the Carangidae, Chlorophthalmidae, Holocentridae, Hoplichthyidae, Rachycentridae, Sciaenidae, Sillaginidae and Tetraodontidae [4–6,12–13,23–24] (Tables 2 and 3, Fig 4). Besides the single specimen of *Pseudempleurosoma* sp. from the sillaginid bay whiting *Sillago ingenuua* McKay, 1985 in Malaysia [22], and misidentified worms from the sciaenid croakers *Argyrosomus japonicus* (Temminck & Schlegel, 1843) and *Johnius carouna* (Cuvier, 1830) in Vietnam [25], this is the third record of an endoparasitic marine monogenean from South East Asia. So far the only other record of *Pseudempleurosoma* from a sciaenid, the banded croaker *P. brasiliensis*, is from the Atlantic, i.e. the southeastern coast of Brazil [6] (see Tables 2 and 3 and Fig 4). In 2011, an endoparasitic Monogenea was isolated from the stomach of sciaenid croakers *A. japonicus* and *J. carouna* in Vietnam [25], close to our area of investigation. The geographic area and the closely related host fish species (all Sciaenidae) as well as the provided drawings of the dorsal bar and the anchors and hooks suggest that the worms identified as *Paradiplectanotrema trachuri* belong to *Pseudempleurosoma* with some similarities to *P. haywardi* sp. nov.. We herewith establish three new host records for *Pseudempleurosoma*.

Morphological characterization

We compare *Diplectanotrema*, *Neodiplectanotrema*, *Paradiplectanotrema*, *Pseudodiplectanotrema* and *Pseudempleurosoma* (Syn.: *Metadiplectanotrema*) in Table 1. The record from the Pacific (Coral Sea, see above) [24] was described as follows: "a sclerotized copulatory organ without an accessory piece, ventral and dorsal anchor/bar complexes, . . .and slender shaft". It was also stated that the genera of the "*Diplectanotrema*-group" are probably synonyms [24]. However, Yamaguti's type specimens of *P. carangis* were re-examined and accessory pieces were found [6]. Consequently, these specimens [24] most likely belong to *Neodiplectanotrema* and not *Pseudempleurosoma*, which is considered to have an accessory piece and a ventral anchor/bar complex. The only other genus in the group lacking an accessory piece is *Pseudodiplectanotrema*, but this taxon lacks a ventral bar. In addition, the description of "a dorsal bar formed as two bilateral sclerotized rudiments" [24] does not fit to the so-far described genera of the "*Diplectanotrema*-group".

The record of *Pseudempleurosoma* sp. [23] from Mozambique did not provide morphometric information, leaving species identification insecure. Measurements were provided for a single specimen from Malaysia [22], revealing similarities to *P. carangis*, based on its general morphology, internal anatomy and hooks [22]. However, the morphology of the haptoral complex was misinterpreted [6,22]. According to our confocal images and illustrations, *Pseudempleurosoma* has two dorsal anchors connected by a single bar, combined with two ventral anchors associated with two bars each, one pair connected and one pair disconnected. The original genus description lacked one pair of ventral bars [4], though, re-examination of the type specimens already documented its presence [6], and "three dorsal bars between the large dorsal anchors" (instead of one) combined with no ventral bar were misinterpreted for the Malaysian specimen [22]. However, figure 12 in that publication [22] shows that two of those dorsal bars are saucer-type excrescence root extensions of the dorsal anchors, that were described in more detail for the Ancyrocephalinae [5] as follows: "outer root extension with chitin containing cap, inner root extension with saucer-type excrescence" (in Russian). Comparing the anchor apparatus of *P. haywardi* sp. nov. (present study, see Figs 1C & 2L–2P) with

Table 3. *Pseudempleurosoma* spp. fish host species ecology and economic value. Note that almost all host species are aggregating or schooling, reef-associated or associated to muddy bottoms, and of commercial importance (fish ecology and economy data from [26]).

			Pseudempleurosoma* species					
Fish host species	**Host ecology**	**Host economic value**	***1***	***2***	***3***	***4***	***5***	***6***
Caranx lugubris (Carangidae)	Oceanic & insular, also outer **reef** edges, nocturnal, occasionally **schooling**	**Commercial aquaculture**	x					
Caranx ruber (Carangidae)	Coral **reef** associated, insular & mainland, juveniles in *Sargassum* spp. weed, **schooling**	**Commercial fisheries**		x				
Caranx sexfasciatus (Carangidae)	Coral **reef** associated, coastal & oceanic, pelagic, nocturnal, stationary **schooling** at daytime, juveniles in estuaries	**Commercial fisheries**	x					
Myripristis berndti (Holocentridae)	Caves & subtidal **reef** flats to outer slopes, benthopelagic, nocturnal, in loose **aggregations**	**Commercial fisheries**	x					
Myripristis jacobus (Holocentridae)	Shallow coral **reefs** to offshore deep water, nocturnal, **aggregating** on reefs, occasionally swims upside down (parasite?)	Minor			x			
Rachycentron canadum (Rachycentridae)	Mud, sand & gravel bottoms, coral **reefs**, mangroves, estuaries, forms **small groups**	**Commercial aquaculture**				x		
Johnius amblycephalus (Sciaenidae)	Shallow **coastal waters** and estuaries, rivers (authors: coastal waters in area of distribution are coral reefs, sand and mud bottoms)	Minor						x
Nibea soldado (Sciaenidae)	Shallow **coastal waters** and estuaries, rivers (authors: coastal waters in area of distribution are coral reefs, sand and mud bottoms)	**Commercial fisheries**						x
Otolithes ruber (Sciaenidae)	**Coastal waters** (authors: coastal waters in area of distribution are coral reefs, sand and mud bottoms)	**Commercial fisheries**						x
Paralonchurus brasiliensis (Sciaenidae)	muddy bottoms, near estuaries	Minor				x		
Sphoeroides testudineus (Tetraodontidae)	bays, creeks, seagrass beds, brackish water, rare/absent on coral reefs, forms huge **aggregates**	None	x					
Trichiurus lepturus (Trichiuridae)	over muddy bottoms of shallow coastal waters, enters estuaries, **schooling** at bottom, **aggregating** at surface	**Highly commercial fisheries**					x	

*1 = *P. carangis*, 2 = *P. caranxi*, 3 = *P. myripristi*, 4 = *P. gibsoni*, 5 = *P. guanabarensis*, 6 = *P. haywardi* sp. nov. (please note that the two additional sciaenid fish species *Argyrosomus japonicus* (commercial fisheries, aquaculture) and *Johnius carouna* (minor commercial) are probably also hosts of *Pseudempleurosoma* [25], see Discussion above)

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the drawings of the generic description with *P. carangis* [4], characterizing this saucer-type excrescence as "dorsal root . . .turned medially to form a dorsal swelling", and with the drawings of the unidentified specimen [22], it is evident that there is just one dorsal bar in the latter worm as well, as known for *Pseudempleurosoma* spp.. Consequently, this specimen can be affiliated with *Pseudempleurosoma*. This structure was also realized for further species [6], stating: "In *P. carangis* and *P. gibsoni* . . .the roots of each dorsal hamulus [= anchor (authors)] are concave, giving the appearance of bars, but in reality there is only one dorsal bar between hamulus." These saucer-type excrescences, used for distinguishing between species of the Ancyrocephalinae [5] were thus misinterpreted as roots [6] or bars [22]. The description of the Malaysian specimen [22] demonstrates closer similarity to our newly described species compared with *P. carangis*. It had an equal length of the dorsal anchors (61 μm), which are largest in *P. haywardi* sp. nov. compared to its congeners (mean around 50 μm), and a very long ventral anchor (24 μm). However, this large size results from misinterpretation of the attached ventral bars as belonging to the ventral anchors, while only two (= one pair) of ventral bars, the attached ventral bar of each ventral anchor, were mentioned and drawn in the generic

description [4]. The detached, free irregular bars were misinterpreted as "anterior medial hooklets [= hooks (authors)] abnormally large". In summary, according to the illustration and measurements provided [22] and the explanation given above, this single worm should be affiliated with *Pseudempleurosoma*, is similar to our new species, and their conspecificity so far cannot be excluded.

Other material, probably *Pseudempleurosoma* sp., misidentified as *Paradiplectanotrema trachuri* [25] (Vietnam, see above), differs from the herein described new species. The body length of this *Pseudempleurosoma* sp. (1.7–2.6 mm with a body width up to 824 μm) and the pharynx size are much bigger than of *P. haywardi* sp. nov. and in the range of the largest congener, *P. guanabarensis*. On the other hand, the MCO of the worms (max. 48 μm) is smaller than in *P. haywardi* sp. nov. (max. 52 μm), which was so far considered to have the smallest MCO. The sizes of the dorsal bar, in shape similar to the one of *P. haywardi* sp. nov., are in the range of the largest congener, displaying the largest dorsal bar, namely *P. guanabarensis*. Dorsal anchors are smaller in this material compared with *P. haywardi* sp. nov. and in the congeners range. Detached ventral bars of the Vietnamese specimens are in the same range as in the congeners, except of the largest species, *P. guanabarensis*, which displays the smallest detached ventral bars. Attached ventral bars were misinterpreted (thus the worms were misidentified as *Paradiplectanotrema*), and thus measurements are not presented, consequently measurements for the ventral (attached) anchor were misinterpreted as well (however, ventral anchors and attached bars as well as detached bars are visible in the drawing of this worm [25]). The worm still has some similarities with *P. haywardi* sp. nov., but differs in several morphological measurements. Again, conspecificity of *P. haywardi* sp. nov. and the Vietnamese worm so far cannot be excluded.

Confocal microscopy made it possible to position structures, providing angle of views for illustrating and comparison as well as accurate measurements, for example the saucer-type excrescences, the exact length of the curved MCO, the irregular shape of its accessory piece, the connection of the hooks and bars or the dorsal bar, showing its length, width and shape accurately (Fig 2). This methodology is found to be suitable to detect minor, often difficult to describe differences in the haptoral structures of these small monogeneans.

Phylogeny and evolution

Without DNA sequence data of diplectanotrems, it was assumed that the evolutionary specialization towards an endoparasitic lifestyle must have happened multiple times separately, for freshwater and marine taxa [5]. With adaptation to the oesophageal folds instead of the gill filaments for attachment, host specificity seems to reduce. This might either be explained by the probably common morphology of oesophageal epithel cells within various fish species compared to the specialized and differentiated gill rakers and especially filaments. Another factor for decreasing host specificity might be the environmental change from living outside the fish (marine; changing abiotical factors such as temperature, salinity, current, oxygen, light) to inside the fish with a constant physiology. We suggest that adaptation from a highly differentiated site (gill filaments) towards a more general site (stomach) can go along with decreasing host specificity. In the case of diplectanotrem monogeneans, the site change has three benefits. Firstly, the newly explored oesophageal folds are neither utilized by other parasitic worms nor by fish parasitic crustaceans, thus they represent a niche only for diplectanotrems, and resource competition is minimized. Secondly, with exploration of the new habitat, many more fish species and families become potential hosts with empty niches, thus spreading of the diplectanotrems can be maximized. Thirdly, because the host species of *Pseudempleurosoma*

spp. appear coastal, often reef-associated, and close to cleaning stations where cleaner fish or shrimp feed on ectoparasites, the new habitat minimizes possible predation.

According to our phylogenetic analysis, *P. haywardi* sp. nov. is a close relative of endoparasitic freshwater monogeneans of *Enterogyrus*, distributed in continental Africa and South East Asia. Cichlid fishes originate from Madagascar, and *Enterogyrus* has been associated with cichlid hosts before the colonization of these two continents [14]. If these genera go back to the same origin, diplectanotrem monogeneans might have developed either already from the very basal freshwater cichlids within historical geographically isolated Madagascar, or from the already advanced African cichlids parasitizing monogeneans, subsequently spreading from Africa into the Indo-Pacific region, with the freshwater forms *Enterogyrus* and the marine diplectanotrems. Most interestingly, while the freshwater endoparasitic monogeneans have been reported to be specific to their cichlid hosts, development into the marine forms reduced the host specificity and allowed subsequent worldwide distribution (see Fig 4).

Conclusion

A new species of endoparasitic monogenean on marine fishes (*Johnius amblycephalus*, *Nibea soldado*, *Otolithes ruber*) from Indonesian waters is described as *Pseudempleurosoma haywardi* sp. nov., based on various unique morphological characteristics as well as on the zoogeographic distribution and hosts. We document different infection rates of the investigated sciaenids, with a prevalence of 46% to 63% (and both *J. amblycephalus* investigated were infected), and up the seven worms in the oesophagus of a single fish. We demonstrate that like the other congeners, *P. haywardi* sp. nov. is less host specific, and might be found in further of the 39 marine sciaenid species occurring in Indonesia (for list of species, see [26]), or possibly in other fish families, for example sillaginids (compare [22]).

It is noteworthy that the so far recorded host fish species (Tables 2 and 3) are of economic interest, most species have fisheries and/or aquaculture importance, and *Trichiurus lepturus* is of high commercial interest for fisheries [26]. Most of the recorded fish species share similarities concerning their ecology (Table 3), either being reef-associated or benthic over muddy bottoms (except the pufferfish which inhabits (brackish) bays); however, all species are schooling or aggregating. Thus it can be concluded that the genus *Pseudempleurosoma* is somewhat associated to aggregations of fish host species over reefs or muddy bottoms (Table 3).

The phylogeny of marine diplectanotrems is decrypted for the first time, securing the position of these endoparasites and supporting an African freshwater origin. Further phylogenetic analysis of other diplectanotrem genera and of *Montchadskyella*, marine endoparasitic Monogenea of armorheads (Histiopterinae) in Southern Australia, will shed more light on their evolution.

Supporting information

S1 Table. Comparative linear measures for *Pseudempleurosoma haywardi* sp. nov. from the type host *Nibea soldado* (Sciaenidae). All measurements in μm, https://figshare.com/s/75cc37ed9297dc11d983.
(XLSX)

S2 Table. Comparative linear measures for *Pseudempleurosoma haywardi* sp. nov. from the additional host *Otolithes ruber* (Sciaenidae). All measurements in μm, https://figshare.com/s/75cc37ed9297dc11d983.
(XLSX)

S1 Fig. Confocal photos of the haptor of *Pseudempleurosoma haywardi* sp. nov. Confocal microscopy illustrations of the opisthaptor with hooks, anchors and bars (dorsal bar concave

anterior) (**A**), with focus on the inner two (of seven) pairs of hooks, partially overlaid by the ventral anchor with both its bars (**B**) and the same in detail (**C**), https://figshare.com/s/75cc37ed9297dc11d983.
(TIF)

S2 Fig. Alignment of sequences. https://figshare.com/s/75cc37ed9297dc11d983.
(TIF)

S1 Permission. Permission to use Fig 4. https://figshare.com/s/75cc37ed9297dc11d983.
(TIF)

S1 Calculation. Calculation of best fitting model for phylogeny studies. https://figshare.com/s/75cc37ed9297dc11d983.
(XLS)

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Endoparasitic *Paradiplectanotrema klimpeli* sp. nov. (Monogenea: Ancyrocephalidae) from the Greater Lizardfish *Saurida tumbil* (Teleostei: Synodontidae) in Indonesia

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Abstract

A new endoparasitic monogenean of *Paradiplectanotrema* Gerasev, Gayevskaya & Kovaleva, 1987, *Paradiplectanotrema klimpeli* sp. nov., is described from the southern Balinese coast, Indonesia. The new species is much larger, wider and characterized by the longest dorsal anchors compared with the congeners. Ventral anchors and ventral bars are the smallest in the genus, with a distinct ratio of 1:1. This is the first species with a gladiator breast-plate-shaped dorsal bar, with a length:width ratio of 1:1. Oesophagi of the Common Grinner *Saurida tumbil* (Bloch, 1795) (Synodontidae) were infected (prevalence = 17%) at an intensity of 12 (1–21). This is the first record of the genus from the eastern Indian Ocean, and lizard-fishes represent a new host family. We provide light microscopy (*in situ* in oesophagal folds), three-dimensional confocal illustrations and a morphometric comparison of all congeners, with remarks on the recently described first Indonesian endoparasitic Monogenea *Pseudempleurosoma haywardi* Theisen, Palm, Al-Jufaili & Kleinertz, 2017. First 28S DNA sequences for *Paradiplectanotrema* allocate the new species close to endoparasitc freshwater monogeneans. Its ecology differs from *Pseudempleurosoma* Yamaguti, 1965 by utilizing deep-water fishes instead of coastal, coral reef-associated hosts; however, both are infecting schooling, bottom-dwelling fishes.

Introduction

Monogenea, a class of the Platyhelminthes, are typically host-specific monoxenous ectoparasites of fish, infecting especially their skin and gills. This can lead to mass mortalities when secondary infections (e.g. bacteria, virus and fungi) are triggerd, e.g. under aquaculture conditions (Zhang *et al.* 2015; Kotob *et al.* 2016). Cephalopods and, more rarely, amphibians, reptiles and cetaceans can be parasitized, one species infects the hippopotamus.

Only few species became endoparasitic in fishes, utilizing e.g. the urogenital and gastro-intestinal system. Besides showing a simple life cycle, a posterior attachment organ called (opist)haptor, armed with clamps, anchors and/or hooks, is unique and differentiates the hermaphroditic Monogenea from other flatworms (Mehlhorn, 2001). Theisen *et al.* (2017) shed light on the morphology of the often misinterpreted anchor apparatus of *Pseudempleurosoma* Yamaguti, 1965, presenting the first laser confocal images of a '*Diplectanotrema* group' member. Within this group (*Diplectanotrema* Johnston and Tiegs, 1922; *Neodiplectanotrema* Gerasev, Gayevskaya & Kovaleva, 1987; *Paradiplectanotrema* Gerasev, Gayevskaya & Kovaleva, 1987; and *Pseudodiplectanotrema* Gerasev, Gayevskaya & Kovaleva, 1987), the species are adapted to attach to the inner epithel cells of the oesophagus, stomach and intestine of a wide range of host species, which is unusual for the commonly ectoparasitic and highly host specific Monogenea. *Pseudempleurosoma haywardi*, Theisen et al., 2017, from the oesophagus of croakers (Sciaenidae) was only recently described as the first endoparasitic Monogenea from Indonesia (Theisen *et al.* 2017).

The genus *Paradiplectanotrema* was established by Gerasev *et al.* in 1987, describing the four species *P. antigoni*, *P. chlorophthalmi*, *P. cytti* and *P. lepidopi*, all from N, NW and SW Africa (Atlantic Ocean). They also transferred *Diplectanotrema trachuri* Kovaleva, 1970 into *Paradiplectanotrema* as the new type species *P. trachuri* (Kovaleva, 1970) Gerasev, Gayevskaya & Kovaleva, 1987. According to the key to the genera by Theisen *et al.* (2017), *Paradiplectanotrema* differs from the above mentioned genera by having a combination of (i) an accessory piece on the male copulatory organ (MCO) and two ventral anchors with (ii) one ventral bar each (one pair of ventral anchors and one pair of ventral bars).

The monogenean species described herein represents a new member of *Paradiplectanotrema*, the first record of this genus from Indonesia, and the second endoparasitic Monogenea species from the eastern Indian Ocean. We document Synodontidae as a new fish host family

for *Paradiplectanotrema*. A morphometrical comparison is made among the valid species within this genus, also *via* detailed three-dimensional confocal microscopy, and first DNA sequence data are presented, securing the phylogenetic position of these marine endoparasites. For the first time, *in situ* images of endoparasitic monogeneans attached to tissue of the oesophageal folds inside their hosts are presented.

Materials and methods

Sample collection and processing

The synodontid grinners *Saurida tumbil* (Bloch, 1795) ($n = 24$) were sampled from Kedonganan fish market, South Bali coast, Indonesia (8°45′25.60″S, 115°10′05.94″E) in November 2016 (rainy season). The fishes were transferred on ice to the Marine and Fisheries Faculty Laboratory, Udayana University (UNUD), Kampus Bukit, Jimbaran, Bali, Indonesia.

Morphometrical data for each fish were taken [total and standard lengths (TL and SL) to the nearest 0.1 cm, total and gutted weight (TW and GW) to the nearest 0.1 g]. The body cavity was opened, the stomach was cut at the level of the pharynx right behind the gill rakers and transferred to Petri dishes containing NaCl solution (0.9%), and studied for parasites under a Zeiss Stemi DV4 binocular microscope. Endoparasitic monogenean parasites were isolated from the pharyngeal/oesophageal folds, washed in saline solution and pre-identified under a Novel XSZ-107BN microscope. Most worms were fixed using AFA (Alcohol: Formalin: Acetic acid) or 4% neutral buffered formalin and then transferred and stored in 70% EtOH for further morphological analyses (light microscopy). Some were either compressed and directly transferred to 95% ethanol for confocal laser scanning microscopy or to 99.8% EtOH for DNA analysis. Type specimens are deposited in the Berlin Natural History Museum, Germany ['Museum für Naturkunde', catalogue 'Entozoa', collection 'Vermes', numbers E.7439 (holotype) and E.7440a–E.7440 h (paratypes)] and the Zoological Museum Bogor, Indonesia (MZBTr240–MZBTr245, paratypes). The ecological parameters for fish infections with *Paradiplectanotrema klimpeli* sp. nov. (prevalence, intensity and abundance) were calculated following Bush *et al.* (1997).

Light microscopy, drawing and morphological investigation

Following standard parasitological methods, specimens were cleared and mounted with glycerin after fixation. Some compressed samples from 70% ethanol were prepared as whole mounts, stained with acetic carmine and studied for sclerotized organs. Measurements are given as the range followed by mean in parentheses (in micrometers), according to the genus description by Gerasev *et al.* (1987) and Kovaleva (1970), respectively. A camera lucida drawing tube was used to illustrate the new species while photographs were taken with a digital camera Olympus UC30 attached to an Olympus BX53 DIC light microscope or a Zeiss SZX10 binocular magnifier, supported with Cellsens Dimension software (Olympus Soft Imaging Solutions GmbH) for measurements.

Confocal microscopy

Confocal laser scanning microscopy was performed following the procedure described in Galli *et al.* (2006) and Marchiori *et al.* (2015) with specimens fixed in 95% ethanol, using a Leica TCS SP2 confocal microscope (laser with HeNe at 543 nm wavelength, minimum setting: 200 z section) equipped with an inverted Leica DMIRE2 microscope and a PL APO 363 oil immersion objective (×63 magnification, numerical aperture 5 1.4) at the Live Cell Imaging Center, Department of Biology, University of Rostock.

DNA analysis

For molecular analysis, total genomic DNA was extracted from individual adult worms fixed in 99.8% ethanol using QIAamp mini DNA kit (Qiagen) according to the manufacturer's instructions with some modification. In order to increase the DNA yield, the obtained DNA was completely evaporated using Concentrator plus/Vacufuge® (Eppendorf), dehydrated DNA was then resuspended with 50 μL of elution buffer and stored in a − 20°C freezer. Amplification of D1–D3 fragments of the large subunit region (LSU) was achieved using the following primers: C1 (forward; 5′-ACCCGCTGAATTTAAGCAT-3′) and D2 (reverse; 5′-TGGT CCGTGTTTCAAGAC-3′) (Mendlová *et al.* 2010). The reaction was performed using illustra™ puReTaq Ready-To-Go PCR beads (0.2 ml tubes, 96 reactions), containing 5 pmol of each primer, 5 μL of DNA suspension and nuclease-free water to a total volume of 30 μL. Obtained PCR products (1 μL) were viewed on a 0.8% agarose gel stained with ethidium bromide. Contiguous sequences were aligned and assembled using BioEdit v.7.0.9 (Hall, 1999). The generated sequences [GenBank accession numbers (GBAN) MG763101] were aligned with their closest matches in GenBank [15 ingroup and *Actinocleidus recurvatus* (GBAN AJ969951) as an outgroup taxa]. Phylogenetic analysis were perfomed in MEGA version 7 (Kumar *et al.* 2016) based on the best scoring model (Bayesian Information Criterion), maximum likelihood was used for the best fitting tree based on the Tamura–Nei model, rates among sites were gamma distributed with invariant sites (G + I), the number of discrete gamma categories was 5, and using complete deletion of gaps as gaps missing data treatment. The robustness of the inferred phylogeny was assessed using a bootstrap procedure with 1000 replications (Wu *et al.* 2005).

Nomenclatural acts

The description of *P. klimpeli* sp. nov. (Life Science species Identifier number (ZooBank LSID): urn:lsid:zoobank.org:act:18989757-3EE3-462E-A389-491A132A6672) complies with the requirements of the International Commission on Zoological Nomenclature (ICZN). The electronic edition of this article conforms to the requirements of the amended International Code of Zoological Nomenclature, and hence the new names contained herein are available under that Code from the electronic edition of this article. This published work and the nomenclatural acts it contains have been registered in ZooBank, the online registration system for the ICZN. The ZooBank LSIDs (Life Science Identifiers) can be resolved and the associated information viewed through any standard web browser by appending the LSID to the prefix 'http://zoobank.org/'. The LSID for this publication is: urn:lsid:zoobank.org:pub: F44C225F-795C-462F-BD33-D1E4BBED9067. The electronic edition of this work was published in a journal with an ISSN, and has been archived and is available from the following digital repositories: PubMed Central and ResearchGate. DNA sequences are available in GenBank under the GBAN MG763101.

Ethics

No experiments were performed on live vertebrates. Freshly caught dead fish was used and therefore no ethics statement is required. Samples were taken in cooperation with Udayana University, Denpasar, Bali under a valid Memorandum of Understanding (MoU). The fishes were obtained from an official fish market (see the 'Material and Methods' section), national laws regulate captures and fishermen/salesmen are

licensed, sampled fish species are common in Indonesia, not protected, and the number of sampled 24 fish were all available individuals.

Results

Taxonomy and description

Family Ancyrocephalidae Bychowsky & Nagibina, 1968

Paradiplectanotrema Gerasev, Gayevskaya & Kovaleva, 1987

History of type species: *Diplectanotrema trachuri* Kovaleva, 1970 became *P. trachuri* (Kovaleva, 1970) Gerasev, Gayevskaya & Kovaleva, 1987

Paradiplectanotrema klimpeli sp. nov.

urn:lsid:zoobank.org:act:18989757-3EE3-462E-A389-491A132A6672

Type-host: Common/Greater Lizardfish/Grinner, *Saurida tumbil* (Synodontidae)

Type-locality: Kedonganan fish market, South Bali coast, Indonesia (8°45′25.60″S, 115°10′05.94″E)

Habitat: oesophageal/pharyngeal folds

Type-material: holotype E.7439; paratypes E.7440a-E.7440h (paratypes) and additional paratypes MZBTr240-MZBTr245

Deposition of specimens: Berlin Natural History Museum, Germany ['Museum für Naturkunde', catalog 'Entozoa', collection 'Vermes', numbers E.7439 (holotype) and E.7440a–E.7440 h (paratypes)], the Zoological Museum Bogor, Indonesia (MZBTr240–MZBTr245, additional paratypes)

Infection: four of 24 fishes harboured 47 specimens, prevalence 17%, mean intensity 12, intensity 1–21, mean abundance 2

Etymology: the specific name is to honor Dr Sven Klimpel for his work on marine fish parasites

Description (all μm) (Figs 1–3): based on 17 specimens from the type host *Saurida tumbil*

Body slender, unspined, 2050–2880 (2390) long; maximum width 600–980 (800) (posterior to testis). Pair of small head glands anterior to oesophagus lateral to eye spots; second, larger pair lateral at level of intestinal bifurcation. Two pairs of eye-spots. Oral aperture ventral; pharynx globular, 106–164 × 112–167 (140 × 142.5) (length × width) (Fig. 1). Intestinal caeca overlaid posterior to testis, coexisting with vitelline follicles, with lateral diverticula lacking haematin pigment. Haptor, 92–131 × 100–147 (116.5 × 125.5) (length × width), not distinctly set off from body, but laterally slightly lobed; with two pairs of dissimilar hamuli (~anchors) and 14 marginal hooks (~hooklets) (Figs 1–3). Dorsal hamuli, from the tip of the ventral root to the height of curve of the blade (with the inner dorsal root being shorter than the outer ventral root in this genus), 55–62 (58) in length, connected by a single gladiator breast-plate shaped dorsal bar with a 1:1 length:width ratio (Figs 1–3), 15–19 (17) from end to end (=width), with a distance of 14–19 (16.5) from anterior to posterior border (=length) (Figs 1 and 3). Ventral hamuli 9–11 (10) in length, each one with one wide (>5) (connected) bar of 9–13 (11) length (Figs 1 and 3). Marginal hooks 11–15 (13) long (Figs 1 and 3). MCO sclerotized, tubular, 67–96 (79.5) long, with seminal vesicle and prostatic reservoir at base; accessory piece sclerotized, irregular in shape, 25–32 (27.5) long (Figs 1 and 3). Testis post-ovarian, shaped like a rounded cumulus cloud, widest anterior, median or posterior, 120–237 × 110–225 (183 × 180) (length × width) (Fig. 1). Ovary turned back on itself, giving an appearance of being kidney shaped, wider than long, 122–159 × 176–239 (143.5 × 207) (length × width) (Fig. 1). Uterus hose shaped, ends as muscular aperture of 33–63 × 40–59 (51.5 × 49) (length × width), in a smooth genital atrium, almost round in shape (Fig. 1). Vagina simple, opens at the level of muscular genital atrium. Vitelline follicles arranged longitudinally in lateral fields along body (Figs 1 and 2). Vitelline ducts unite in a slender line directly anterior to ovary. Eggs oviform, 50–104 × 46–66 (84 × 52) (length × width) (Fig. 1).

Remarks

Based on Santos *et al.* (2001) and Theisen *et al.* (2017), the new species belongs into *Paradiplectanotrema* due to the presence of an accessory piece on the MCO and one bar associated with each ventral anchor as well as one bar connecting the two dorsal anchors (one pair of dorsal anchors, one pair of ventral anchors, one pair of ventral bars, one dorsal bar).

The specimens represent a new species, as seen in Table 1. While the sizes of the marginal hooklets, MCO and eggs are similar in all species of this genus (Table 1), other morphological measurements are distinct. *Paradiplectanotrema klimpeli* sp. nov. differs from all congeners by having a longer body with a mean of 2390 (2050–2880). So far, only few specimens of *P. trachuri* have been reported being longer than 2 mm; however, the mean length of *P. trachuri* [1680 (1030–2220)] is smaller (see Table 1). The body width of *P. klimpeli* sp. nov. [800 (600–980)] is wider than the congeners' (mean of 450–500) (Table 1). The widest part of the body lies half way between testis and opisthaptor (while in *Pseudempleurosoma* it lies at the level of the testis). With a length of 55–62 (58), the dorsal anchors are the longest in the genus, even though the size of the dorsal anchor of *P. antigoni* is almost as large (up to 60 with a mean of 57.5). Thus, the dorsal anchor length alone is characteristic to distinguish *P. klimpeli* sp. nov. from its congeners except *P. antigoni*.

A unique character of the new species is the shape of the dorsal bar being gladiator breast-plate shaped, with a 1:1 length:width ratio, while all so far decribed dorsal bars of the congeners have different shapes and ratios (Gerasev *et al.* 1987). Thus, the two structures of the dorsal anchor complex, namely, the dorsal hooks and the dorsal bar of *P. klimpeli* sp. nov., are unique. The ventral anchor is the smallest in this new species. With sizes of 9–11 (10), it differs from its congeners with means between 12.5 and 15. The bar of the ventral hamuli has smaller sizes (mean 11) compared with the congeners (means between 12.5 and 16) (Table 1).

The amount of eggs in *P. klimpeli* sp. nov. is noteworthy, with up to four eggs per specimen, similar to other species within the genus (up to three eggs), but in comparison with *P. haywardi*, that had nil to a maximum of one egg *in utero*. Other differences from the congeners is the host species, with the Synodontidae representing a new host family for the genus, and the geographic range in Indonesia, South-East Asia. The sampled grinners had sizes of 14.5–34.2 cm SL, with TW of 32.6–447.2 g. The infected four-type host fish specimens were comparably large, with 26.6/239.5, 29.9/285.1, 29.6/304.4 and 34.2/447.2 [SL (cm)/TW (g)].

DNA

The partial LSU rDNA sequences were 838 bp long (with primers). A NCBI GenBank blast showed closest similarity to the only so far available sequence of a member of the *Diplectanotrema* group, namely *P. haywardi* (GBAN MF115714–MF115717), followed by freshwater endoparasitic monogeneans, namely *Enterogyrus* 'sp. 1 AS-2010', *Enterogyrus* 'sp. 2 AS-2010' [both *ex Sarotherodon galilaeus* (L.)], and *Enterogyrus coronatus* Pariselle, Lambert & Euzet, 1991 *ex Coptodon zillii* (Gervais, 1848) (GBAN: HQ010032, HQ010031, HQ010030). The obtained sequence of *P. klimpeli* sp. nov. formed a well-supported sister clade with *P. haywardi* (bootstrap value of 100%) (Fig. 4). The new sequence is available under the GBAN MG763101.

Fig. 1. Drawings of *Paradiplectanotrema klimpeli* sp. nov. Holotype from the type fish host *Saurida tumbil* (**A**), with detailed view of reproductive system with genital atrium/disc (mga), male copulatory organ (MCO) with accessory piece, and prostatic reservoir (pr) and gland at base; and egg in uterus (B) and opisthaptor with anchors (one dorsal and one ventral pair), bars (one between dorsal anchors and one attached to each ventral anchor = three) and seven pairs of hooklets (C); scale bars A: 100 μm; B & C: 10 μm.

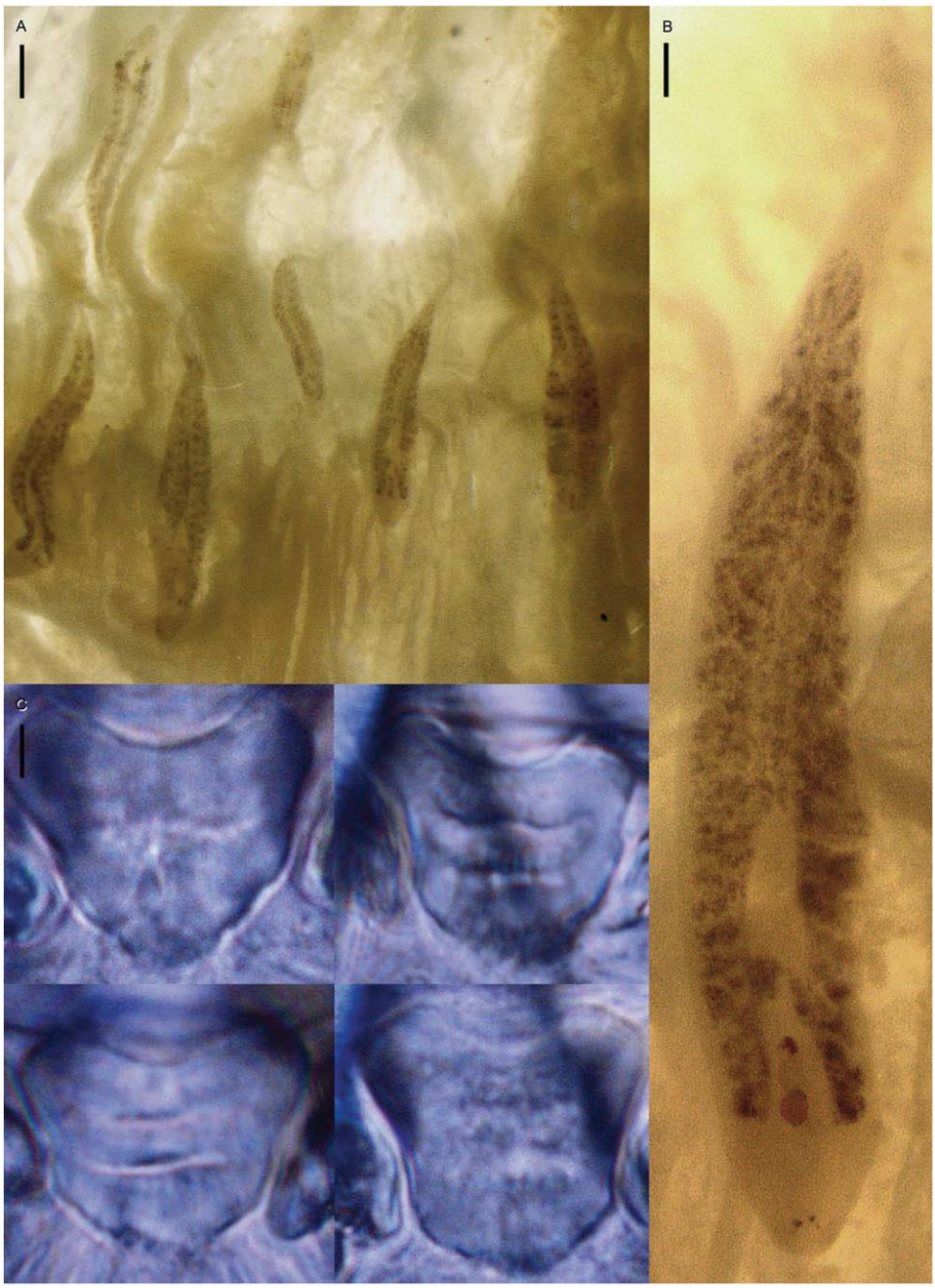

Fig. 2. Light microscopy illustrations of *Paradiplectanotrema klimpeli* sp. nov. Worms *in situ*, attached to its hosts oesophageal epithel folds (A, binocular), detailed individual *in situ* (B), gladiator breast-plate shaped dorsal bar of four different individuals (C, DIC).

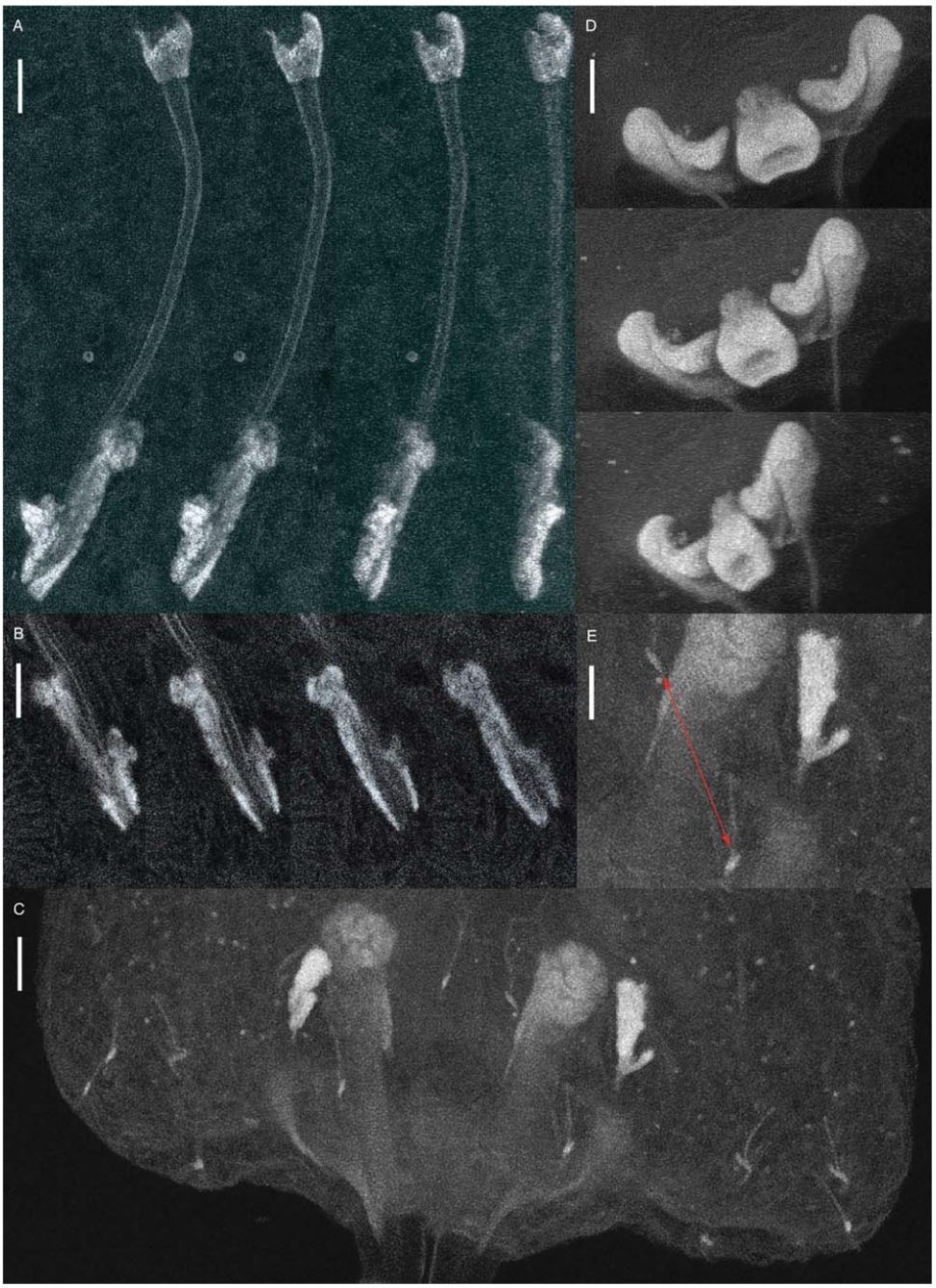

Fig. 3. Confocal laser scanning illustrations of *Paradiplectanotrema klimpeli* sp. nov. Male copulatory organ (MCO) in different angels (A) and levels (B), haptor (C) with dorsal anchors' saucer-type excrescences and dorsal bar stained, from different angels (D), and detailed view of two central hooks (red arrow), base of a dorsal anchor and a ventral anchor with its associated, irregular ventral bar (E); scale bars: A–D: 10 μm; E: 15 μm.

Table 1. Morphological measurments of the now six species of *Paradiplectanotrema*

Measurements (all μm)	*P. antigoni* Gerasev, Gayevskaya & Kovaleva, 1987 *n* = 2	*P. chlorophthalmi* Gerasev, Gayevskaya & Kovaleva, 1987 *n* = 7	*P. cytti* Gerasev, Gayevskaya & Kovaleva, 1987 *n* = 1	*P. lepidopi* Gerasev, Gayevskaya & Kovaleva, 1987 *n* = 23	*P. trachuri* (Kovaleva, 1970) Gerasev, Gayevskaya & Kovaleva, 1987 *n* = 16 in re-description	*P. klimpeli* sp. nov., present study *n* = 17
Body (length × width)	1000[a] × 360–550 (1000 × 450)	700–1660 × 280–970 (1330 × 500)	1620 × 280[a]	780–2190 × 280–620 (1400 × 470)	1030–2220 × 300–650 (1680 × 450)	**2050–2880 × 600–980 (2390 × 800)**
Opisthaptor (length × width)						92–131 × 100–147 (116.5 × 125.5)
Pharynx (length × width)						106–164 × 112–167 (140 × 142.5)
Ovary (length × width)						122–159 × 176–239 (143.5 × 207)
Testis (length × width)						120–237 × 110–225 (183 × 180)
Dorsal anchor	55–60 (57.5)	40–50 (45.5)	55[a]	48–58 (51.5)	45–55 (50)	**55–62 (58)**
Dorsal bar (length × width)	20 × 12.5[a]	12.5–20 × 10–17.5 (19 × 11.5)	15 × 12.5[a]	15–20 × 9–18 (17.5 × 11.5)[b]	12.5–20 × 7.5–15 (17 × 11)	**14–19 × 15–19 (16.5 × 17)**
Ventral anchor	15[a]	14.5[a]	15[a]	12–15 (14)[b]	11.5–15 (12.5)	**9–11 (10)**
Ventral bar	16[a]	12.5[a]	13.5[a]	10–16 (13.5)[b]	10–16 (12.5)	**9–13 (11)**
Marginal hooks (14 pcs)	14.5 (/15)[a,b]	12.5–15 (14)	12[a]	10–16 (13)[b]	10.5–15.5 (13.5)	11–15 (13)
Male copulatory organ (MCO)	79–97.5 (88.5) × 1	85.5–110 (99) × 1.5	80 × 1[a]	86–92 (88.5) × 1	70–80 (75) × 2	67–96 (79.5)
Accessory piece of MCO						25–32 (27.5)
Muscular genital atrium (length × width)						33–63 × 40–59 (51.5 × 49)
Egg (length × width)		77–90 × 42.5–80 (86.5 × 63)	72.5 × 57.5[a]	67.5–75 × 42.5–62 (67 × 62) *(/70 × 48)*[b]	65–77.5 × 45–67 (67.5 × 50)	50–104 × 46–66 (84 × 52)
Hosts	***Antigonia capros* (Caproidae)**	***Chlorophthalmus atlanticus*, *C. agassizi* (Chlorophthalmidae)**	***Cyttus* cf. *traversi*[c] (Zeidae)**	***Lepidopus caudatus* (Trichiuridae)**	***Trachurus trachurus*, *T. mediterraneus*, *T. picturatus* (Carangidae)**	***Saurida tumbil* (Synodontidae)**
Geographical area	Atlantic: Off Guinea-Bissau (NW Africa)	Atlantic: Off Guinea-Bissau & Angola (NW & SW Africa)	Atlantic: Off N Africa	Atlantic: Off Western Sahara (NW Africa)	Atlantic: Off Western Sahara; Mediterranean: Gibraltar channal (NW Africa)	**Pacific: Off South Bali, Indonesia**

Main differences are in bold.

[a]Only mean/one value is given in Gerasev *et al.* (1987) (thus, no statistical tests could be performed); note that details of former measurements are only available for the species *P. lepidopi* and *P. trachuri* (both show similar values and were sampled in the same region), although all species were (re-)described in one publication (see text) with $n > 1$ for each species except for *P. citty* (see also discussion).

[b]Gerasev *et al.* (1987) provided different values for this character within one species (partially shown in *italics*), resulting from mounting (squeezing) techniques and/or omitting juvenile specimens from the measurements.

[c]Gerasev *et al.* (1987) identified *Cyttus* sp. as host, however, out of the three valid *Cyttus* spp., only *C. traversi* is known from the African West coast (Atlantic).

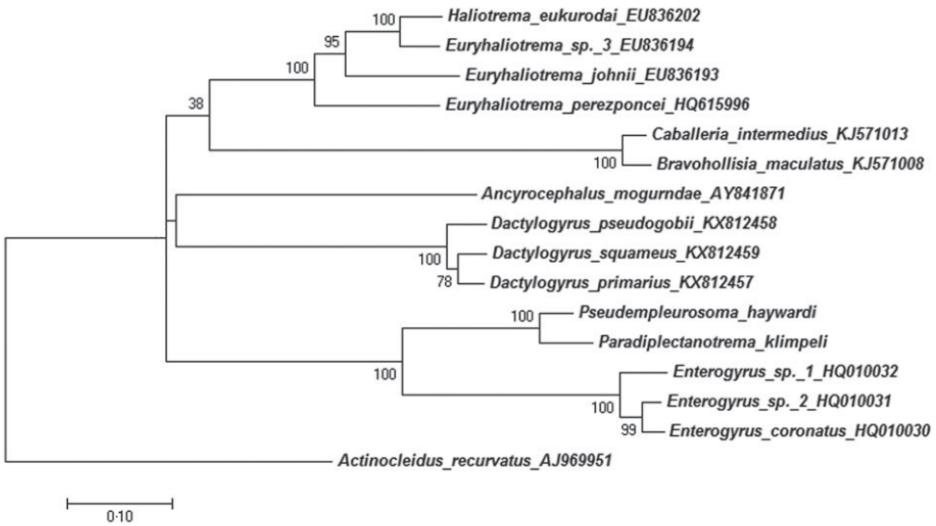

Fig. 4. Maximum-likelihood tree inferred from the analysis of LSU rDNA. The generated sequences were aligned with their closest matches in GenBank (15 ingroup and *Actinocleidus recurvatus* as outgroup) and formed a sister clade with *Pseudempleurosoma haywardi* (bootstrap value 100%), and with a branch of freshwater endoparasitic Monogenea from Cichlidae. Phylogenetic analysis based on the Tamura–Nei model with complete deletion used as gaps missing data treatment. The robustness was assessed using a bootstrap procedure with 1000 replications (Wu *et al.* 2005; Kumar *et al.* 2016).

Discussion

Morphological characterization

Gerasev *et al.* (1987) described several species of the *Diplectanotrema* group and named them after their respective teleost host, as seen in the description of the five *Paradiplectanotrema* spp. The morphological measurements of these species, all documented from the same region (African Atlantic coast), appear similar (Table 1). However, the descriptions were based on few specimens ($n = 2$ *P. antigoni*, $n = 7$ *P. chlorophthalmi* and $n = 1$ *P. cytti*), making detailed comparisons rather difficult. In addition, Gerasev *et al.* (1987) provided a broader range of intraspecific measurements for the same character, possibly resulting from mounting (squeezing) techniques and/or omitting juveniles. Future DNA analyses of the West African species of *Paradiplectanotrema* are needed to confirm their validity and so far recorded host specificity (see Table 1). On the other hand, *P. klimpeli* sp. nov. can be clearly distinguished by the body and dorsal anchor length, the shape of the dorsal bar being gladiator breast-plate shaped (in upside-down view, see Fig. 2), and further parameters as summarized in Table 1. A number of misinterpretations of the morphology of the anchor apparatus of the *Diplectanotrema* group has been published over the years (compare Theisen *et al.* 2017). Confocal images can clearly illustrate these important structures for diagnoses, and we herewith provide the first confocal images for a *Paradiplectanotrema* species (Fig. 2). Confocal microscopy enabled us to position structures, providing angle of views for illustrating and comparison as well as accurate measurements, for example the saucer-type excrescences, the exact length of the curved MCO, the irregular shape of its accessory piece, the connection of the hooks and bars or the dorsal bar, showing its length, width and shape accurately (Fig. 3). This methodology is found to be suitable to detect minor, often difficult to describe differences in the haptoral structures of these small monogeneans (also see Theisen *et al.* 2017).

The (sub-)generic (re-)descriptions of *Diplectanotrema* by Johnston and Tiegs (1922) and Price (1937) are based on the type species *Diplectanotrema balistes* (MacCallum, 1915) Johnston and Tiegs, 1922. According to Gerasev (pers. comm. 2017), all (re-) descriptions seem to have misinterpreted the anchor apparatus (discussion on *Pseudempleurosoma* in Theisen *et al.* 2017), with *D. priacanthi* Lebedev, 1968 still awaiting re-examination in the future. The first adequate diagnosis for *Pseudempleurosoma* as well as *Paradiplectanotrema* were provided by Gerasev *et al.* (1987). However, confocal illustrations of specimens belonging to all so far described genera within the *Diplectanotrema* group, describing the sclerotized structures of the anchor apparatus, are needed to distinguish the so far five valid genera (incuding *Diplectranotrema*, see Theisen *et al.* (2017), especially their Table 1) and clarify the synonymies within this group of monogeneans.

Zoogeography and host range

The five so far described *Paradiplectanotrema* species have been reported exclusively from the Atlantic Ocean, off the coasts of West Africa [Guinea-Bissau, Western Sahara, Strait of Gibraltar (NW) and Angola (SW, also W Mediterranean)], along with their to date reported hosts (a caproid fish for *P. antigoni*, two chlorophthalmid species for *P. chlorophthalmi*, a zeid fish for *P. cytti*, a trichiurid fish for *P. lepidopi* and three carangid hosts for *P. trachuri*) (Table 1). This is the second description of an endoparasitic marine monogenean in South East Asia, the Indian Ocean respectively, suggesting a wider distribution also for other endoparasitic monogeneans of the *Diplectanotrema* group.

Here we establish a new host and family record for *Paradiplectanotrema*. It was already pointed out by Santos *et al.* (2001) and Theisen *et al.* (2017) that, although monogeneans are known for being host specific, site selecting and well adapted, the closely related *Pseudempleurosoma* (see below the 'Phylogeny and Evolution' section) has a variety of different host families and internal sites (from the beginning to the end of the gastro-intestinal system), and was also randomly collected from the gills. Theisen *et al.* (2017) summarized 14 different host species from seven families reported for the seven *Pseudempleurosoma* spp. worldwide (circum-equatorial). It is possible that

Paradiplectanotrema might also have a lower host specificity (see Table 1 and Table 1 in Theisen *et al.* 2017) and a worldwide equatorial occurrence as well (Atlantic and Pacific, see also below the 'Phylogeny and Evolution' section). The oesophagus and pharynx are widely neglected host sites in the research of endoparasitic monogeneans, and the worms are hidden in the oesophageal folds (Fig. 2), covered by mucus. Consequently, further samples are needed to answer the real host and site specificity within this genus.

Concerning the host ecology, the so far known host species of *Paradiplectanotrema* spp. are, just like in *Pseudemplerosoma* spp., associated with muddy bottoms, infecting bottom-dwelling and sometimes schooling fish. However, while all hosts of *Pseudempleurosoma* spp. are associated with coastal waters and reefs, the host species of *Paradiplectanotrema* are deep-water fishes (see Table 2 here and Table 3 in Theisen *et al.* (2017)).

Infection pattern

We provide infection rates with SLs of the host fishes, also for the sciaenid *P. haywardi* hosts (Theisen *et al.* 2017, including unpublished data). Within the sample of grinners [14.5–34.2 SL (in cm), 32.6–447.2 TW (in g)], the infected four type host fish specimens were comparable in size. With four of 24 fishes harbouring 47 specimens, the prevalence was 17%, with a mean intensity of 12 and mean abundance of 2. According to own observations, the infections of Indonesian croakers with *P. haywardi* showed higher prevalences of 63% (22 of 35 fishes infected with 65 worms for *Nibea soldado*) and 46% (16 of 35 fishes infected with 32 worms for *Otolithes ruber*), but lower mean intensities of 3 (*N. soldado*) and 2 (*O. ruber*), intensities of 1–7 (*N. soldado*) and 1–6 (*O. ruber*), mean abundances of 2 (*N. soldado*) and 1 (*O. ruber*). Analysed soldier croakers had an SL of 20.0 (17.5–22.5) and a TW of 155.0 (99.5–211.4), the infected ones were of 17.5–21.8 SL and 99.5–203.3 TW, and the largest individual was negative. Investigated tiger-toothed croakers had an SL of 15.2 (13.7–17.1) and TW of 54.8 (41.6–78.1), the infected ones were of 13.7–16.7 SL and 41.6–71.0 TW, with the largest investigated individual being also negative (Theisen *et al.* 2017, including unpublished data). Only two *J. amblycephalus* (SL 22.6/24.6, TW 258.2/202.2) were screend for *P. haywardi* (see Theisen *et al.* 2017), and both were found to be infected (with three and five worms, respectively). Therefore, we can summarize that Indonesian fishes infected with endoparasitic monogeneans of the *Diplectanotrema* group are bottom-dwelling, are genarally schooling, and of a middle size range, showing a TL/TG of 13.7–24.6/41.6–258.3 for croakers and 26.6–34.2/239.5–447.2 for grinners. It is interesting to note that the eggs in this monogenean group are few (maximum four eggs per specimen) and might infect the host of origin. However, bottom-dwelling schooling fish often ingest and disgorge bottom material such as mud and sand while searching for food, which might be a possible way for transmitting the eggs and parasite infection to another host.

Theisen *et al.* (2017) sampled *P. haywardi* in May and July 2011 (dry sesason) off the South coast of Central Java, and again during sampling of *P. klimpeli* sp. nov. in November 2016 (rainy season) off South Bali. The re-covering of the species within only two examined potential host organisms, almost 1000 km remote off the type locality, and 5 years later, during the rainy season, demonstrate the real abundance of *P. haywardi* in coastal Indonesian sciaenids. We conclude that, firstly, Indonesia is a marine reef fish biodiversity hotspot, secondly, *Pseudempleurosoma* spp. show low host specifity, and thirdly, fish parasitology research is still limited in Indonesian waters and the infection site, the oesophagus and pharynx, has been neglected in Monogenea research surveys. Furthermore, the tiny transparent worms are regularly covered by mucus in the pharyngeal folds of their host and are difficult to detect (compare Fig. 2A: magnified, transilluminated and without mucus). Taking deep-sea fishes into account, which also show a high biodiversity in Indonesia, we suggest that many more host records and probably species of these endoparasitizing genera might be present in the region.

Phylogeny and evolution

Theisen *et al.* (2017) provided the first DNA sequences for a marine endoparasitic monogenean, namely *P. haywardi*, a member of the *Diplectanotrema* group, and ensured its position within the Dactylogyridae. Thus far, it was assumed that evolution towards an endoparasitic lifestyle must have happened multiple times within the Monogenea, for freshwater and marine species separately. This might still be possible, because lacking DNA sequence data of *Montchadskyella*, marine endoparasitic Monogenea of armorheads (Histiopterinae) in Southern Australia, are not affiliated to the *Diplectanotrema* group, and might have been evolved separately. However, Theisen *et al.* (2017) demonstrated the close relationship of *Pseudempleurosoma* and *Enterogyrus*, the latter is a freshwater endoparasitic monogenean from African Cichlidae fishes.

With the present study, we provide the first DNA sequences for the genus *Paradiplectanotrema*. The 28S region is found to be suitable for differentiation of diplectanotrem species and genera, however, the detected differences between the two diplectanorems of 2% in query cover and 8% in identity (according to NCBI GenBank Nucleotid Blast) can be primarily attributed to the two analysed species belonging to different genera, with similar generic differences occuring for example between respective species in the genus *Dactylogyrus* (or *Enterogyrus*, see Fig. 4). The relationship of two different genera within the *Diplectanotrema* group, was only based on morphology and ecology, but could be also now confirmed genetically (Fig. 4). The necessity of analysing further diplectanotrem species and genera will (i) help to understand the distribution patterns and evolution of a monogenean endoparasitic lifestyle through the world's oceans, and (ii) help to confirm validity and synonymy within the diplectanotrem taxa of less described species.

Conclusion

A new species of endoparasitic monogeneans in the marine lizardfish *S. tumbil* from Indonesian waters was described as *P. klimpeli* sp. nov., based on unique morphological characteristics, zoogeography, host distribution and DNA markers. Indonesian fish infections with endoparasitic monogeneans of the *Diplectanotrema* group can be abundant, their hosts known so far show medium sizes (13.7–34.2 cm SL, 41.6–447.2 g TW). All hosts of *Paradiplectanotrema* and *Pseudempelurosoma* are related to muddy bottoms, show schooling behaviour, and some are of commercial value. While the genus *Pseudempleurosoma* is associated with coastal reefs, *Paradiplectanotrema* occurs strictly in deep waters.

The phylogeny of marine endoparasitic *Paradiplectanotrema* was postulated for the first time, securing the position of these endoparasites and supporting an African freshwater origin. The *Diplectanotrema* group is ideally suited to analyse the spreading of a respective lifestyle and the worldwide colonization out of African waters into the world's oceans.

Table 2. *Paradiplectanotrema* spp. fish host species ecology and economic value

Fish host species	Host ecology[a]	Host economic value[a]	*Paradiplectanotrema* species[b]					
			1	*2*	*3*	*4*	*5*	*6*
Antigonia capros	Demersal, depth range 50–**900 m**, usually 100–300 m, adults **close to bottom**, juveniles in mid-water	Minor commercial	x					
(Caproidae)								
Chlorophthalmus atlanticus	Bathy**demersal**, depth range 240–**270 m (probably deeper)**, inhabits deep-water of the continental shelf	N.e.		x				
(Chlorophthalmidae)								
Chlorophthalmus agassizi	Bathy**demersal**, depth range 50–**1000 m**, 5–13 °C, on continental shelf and upper slope **over mud and clay bottom**, schooling habit indicated, juveniles pelagic near surface, adults demersal	Minor commercial		x				
(Chlorophthalmidae)								
Cyttus traversi[c]	Bathy**demersal**, depth range 200–**1000 m**, 17 °C, offshore waters, juveniles pelagic in surface waters	**Commercial fisheries**			x			
(Zeidae)								
Lepidopus caudatus	**Bentho**pelagic, oceanodromous, depth range 40–**620 m**, 24 °C, continental shelf, along edge and upper slope, **over sandy and muddy bottoms**, in midwater at night, schooling	**Highly commercial fisheries and gamefish**				x		
(Trichiuridae)								
Saurida tumbil	reef-associated, amphidromous, depth range 20–**700 m**, 27 °C, **on muddy bottoms and trawling grounds**	**Commercial fisheries**					x	
(Synodontidae)								
Trachurus trachurus	Pelagic-neritic, oceanodromous, depth range 0–**1050 m**, usually 100–200 m, 17 °C, adults schooling coastal **over sandy substrate**	**Highly commercial fisheries and gamefish**						x
(Carangidae)								
Trachurus mediterraneus	pelagic-oceanic, oceanodromous, depth range 0–**500 m**, usually 5–250 m, 19 °C, **adults near bottom**, at times also in surface waters, migratory in large schools	**Commercial fisheries and gamefish**						x
(Carangidae)								
Trachurus picturatus	**Bentho**pelagic, oceanodromous, depth range (of adults) 300–**370 m**, 20 °C, neritic zones of island shelves, banks and sea mounts, schooling	**Commercial fisheries**						x
(Carangidae)								

Note that all host species are – in contrast to hosts of the members of coastal, reef-associated *Pseudempleurosoma* – deep-water fishes, sometimes schooling, and – similar to *Pseudempleurosoma* – associated with muddy bottoms; some fish host species have commercial value, N.e.: not evaluated, bold font marks similarities.

[a]Data from Froese and Pauli (2017).

[b]1 = *P. antigoni*, 2 = *P. chlorphthalmi*, 3 = *P. cytti*, 4 = *P. lepidopi*, 5 = *P. klimpeli* **sp. nov.**, 6 = *P. trachuri*.

[c]Gerasev *et al.* (1987) identified *Cyttus* sp. as host; however, out of the three valid *Cyttus* spp., only *C. traversi* is known from the African West coast (Atlantic) (Froese and Pauli, 2017).

Supplementary material

The supplementary material for this article can be found at https://doi.org/10.1017/pao.2018.8

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Conflict of Interest. None.

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5. Bray RA, Palm HW, Theisen S (2018) ***Bucephalus damriyasai* sp. nov. (Digenea; Bucephalidae) from the Blacktip trevally, *Caranx heberi* (Bennett, 1830) (Perciformes: Carangidae) from Bali, Indonesia.** Systematic Parasitology, open access.

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Bucephalus damriyasai n. sp. (Digenea: Bucephalidae) from the blacktip trevally *Caranx heberi* (Bennett) (Perciformes: Carangidae) off Bali, Indonesia

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Abstract The new species *Bucephalus damriyasai* n. sp. is described from *Caranx heberi* (Bennett) from off Bali, Indonesia. It can be distinguished from other *Bucephalus* spp. recorded from carangid hosts by its narrow elongate body shape and the relatively long distance between the rhynchus and the vitellarium, as well as other features distinguishing it from individual species. The most similar species are differentiated from *B. damriyasai* n. sp. as follows: *B. carangis* Yamaguti, 1970 has a much greater length, the rhynchus is smaller and the cirrus-sac is small, not always reaching to the posterior testis; *B. fragilis* Velasquez, 1959 is a tiny species, the pre-vitelline distance is short and the caecum is saccular; *B. gorgon* (Linton, 1905) is much longer and relatively broader, the uterus reaches distinctly anterior to the vitellarium and the rhyncheal tentacles appear more complex; *B. labracis* Paggi & Orecchia, 1965 is distinctly longer, slightly broader, with a slightly larger rhynchus, and has shorter pre-uterine and pre-mouth distances; *B. paraheterotentaculatus* Velasquez, 1959 is much longer, relatively rather broad, the rhynchus is said to bear 21 tentacles, the post-testicular region and cirrus-sac reach are longer and the caecum is described as saccular; *B. sphyraenae* Yamaguti, 1952 is longer, slightly broader, the uterus reaches anteriorly to the vitellarium and the caecum is claviform and oriented anteriorly; *B. margaritae* Ozaki & Ishibashi, 1934 (syn. *B. varicus* Manter, 1940) is relatively squat, has shorter pre-vitelline and pre-mouth distances and a longer post-testicular distance and cirrus-sac reach; *B. yamagutii* Gupta & Singh, 1985 is broader, with a relatively short pre-vitelline distance, the caecum extends anteriorly to the pharynx, but not posteriorly and the rhynchus is said to carry five tentacles. The distinctive features of *B. damriyasai* n. sp. are compared with those of all other marine *Bucephalus* spp. in a table. The number of bucephalid trematodes known from Indonesian waters is now 13, two of them await further identification. They have been described from the fish families Carangidae, Platycephalidae, Sciaenidae, Serranidae and Sphyraenidae.

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Introduction

The Indonesian fish parasite fauna is species-rich, resulting from the high number of fish species surrounding about 17,000 islands of this maritime nation. However, though being a hot spot of aquatic biodiversity, fish parasites are far less studied. As stated by Bray & Palm (2009) and considering recent studies (Bray et al., 2016; Yong et al., 2016; Bray et al., 2017), over 80 fish-parasitic trematode species have been reported from Indonesian waters.

According to Palm & Bray (2014), many fish parasites that have been reported off the Hawaiian Islands in the Central Pacific have an Indo-Pacific or even worldwide distribution. Although it can be expected that a high number of new trematode taxa will be described from Indonesia, the same importance should be placed on having reliable identifications of already known species from other regions. Without proper identification the use of fish parasites as biological indicators (Palm, 2011), of increasing importance in many regions (Truong et al., 2017), is difficult and in some cases impossible. Palm & Rückert (2009), Palm et al. (2011) and Neubert et al. (2016) have developed a method to use grouper fish parasites as biological indicators for pollution and environmental change in Indonesian coastal waters, but several bucephalids recovered were only tentatively identified (Bray & Palm, 2009).

The genus *Bucephalus* Baer, 1826 includes many species reported from fresh and marine waters. It is characterised by having a sucker-like rhynchus with a hood bearing tentacles (usually seven). The tentacles may be found withdrawn and difficult to see and in such cases the worms look very similar to members of *Rhipidocotyle* Diesing, 1858. Recent molecular studies by Nolan et al. (2015) have indicated that the genus is polyphyletic, with at least three separate monophyletic groups embedded within an assortment of species of *Rhipidocotyle*, *Prosorhynchoides* Dollfus, 1929 and *Paurorhynchus* Dickerman, 1954.

Caranx heberi (Bennett) (syn. *C. sem* Cuvier) is a common carangid throughout the Indo-Pacific region. The only reports of digeneans we are aware of from this host are the bucephalid *Bucephalus margaritae* Ozaki & Ishibashi 1934 from off Natal, South Africa (Bray, 1984) and an unidentified sclerodistomid *Prosorchis* sp. from the Arabian Gulf (El-Naffar et al., 1992; Al Kawari et al., 1996). We herewith present a description of new bucephalid species from this host from the Balinese coast, Indonesia.

Materials and methods

The present study is based on material collected during the First Educational Workshop on Marine Fish Parasites in Bali, July 21st - August 2nd 2013, of Indonesian and international students and researchers investigating a wide range of hosts from Balinese waters. Three specimens (15.7–16.7 cm total length, 66.2–70.6 g) of *Caranx heberi* were caught by artisanal fishermen and landed at Kedonganan Bay, transported alive into the laboratory of the Veterinary Faculty, Udayana (UNUD) University, Denpasar, Bali, and directly studied for fish parasites. Kedonganan Bay is located at the western side of the southern tip of Bali, directly next to the Ngurah Rai Kuta international airport. The airstrip of the airport reaches into the ocean and acts as the northern border of the bay. Kedonganan is a typical fishing village but is heavily influenced by tourism. There is no harbour; the small ships lay directly in front of the beach which is used to land captures. The fishermen catch fish from the Bali Strait and from nearby areas off South Bali and East Java. They use drift nets, troll lines and hand lines. A cooperation of the local fishermen manages the market (Proctor et al., 2003). Digeneans were collected according to the gut wash methodology described by Cribb & Bray (2010). Unfortunately, although these worms were collected with a view to sequencing, these specimens have not yielded usable rDNA.

Whole-mounts were stained with Mayer's paracarmine, cleared in beechwood creosote and mounted in Canada balsam. Measurements were made through a drawing tube on an Olympus BH-2 microscope, using a Digicad Plus digitising tablet and Carl Zeiss KS100 software adapted by Imaging Associates, and are quoted in micrometres, as the range and the mean in parentheses. 'Cirrus-sac reach' is the distance between the posterior extremity of the worm and the anteriormost extent of the cirrus-sac. The type-material is deposited in the following museum collections: the Natural History Museum, London, UK (NHMUK); the National Biodiversity Collection, Museum Zoologicum Bogoriense, Cibinong, Bogor, Java,

Indonesia (MZB); and the Natural History Museum, Berlin, Germany (ZMB).

Results

All *C. heberi* sampled were infected with a new bucephalid (100% prevalence), but levels of intensity were not recorded.

Family Bucephalidae Poche, 1907
Genus *Bucephalus* Baer, 1827

Bucephalus damriyasai n. sp.

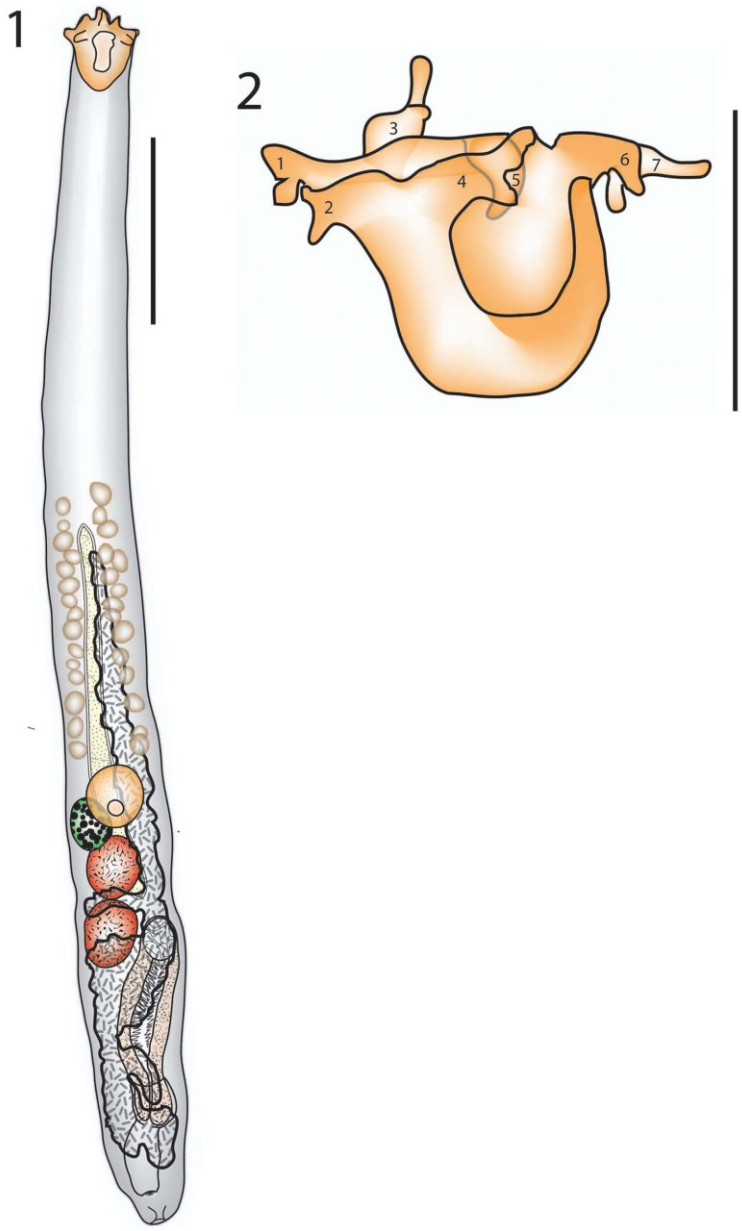
Type-host: *Caranx heberi* (Bennett) (Perciformes: Carangidae), blacktip trevally.
Type-locality: Off South Bali, Indonesia. Purchased from artisanal fishermen, 23.vii.2013, 26.vii.2013, 31.vii.2013.
Type-specimens: Holotype ZMB E.7629. Paratypes: E.7630–1; MZBTr 246–250; NHMUK 2018.6.7.1–3.
Site in host: Intestine.
ZooBank registration: To comply with the regulations set out in article 8.5 of the amended 2012 version of the *International Code of Zoological Nomenclature* (ICZN, 2012), details of the new species have been submitted to ZooBank. The Life Science Identifier (LSID) for *Bucephalus damriyasai* n. sp. is urn:lsid:zoobank.org:act:F68217B4-831B-4D2A-84CE-F731F41CFCFC.
Etymology: This species is named in honour of Professor Dr I Made Damriyasa, Faculty of Veterinary Sciences, Udayana University, for his continuous support of fish parasite research in Balinese waters.

Description (Figs. 1, 2)

[Based on 15 whole-mount preparations.] Body elongate, narrow, gradually widening to maximum at about level of gonads; length 851–1,544 × 76–123 (1,126 × 97); width 7.57–10.4 (8.71)% of body length. Tegument spinous throughout; spines tiny. Rhynchus 67–85 × 55–87 (77 × 71), bearing 7 tentacles, each with side branches and elongate central branch; most often withdrawn and difficult to see; rhynchus length 5.53–8.34 (7.01)% of body length; rhynchus width 77.8–112 (92.7)% of rhynchus length. Mouth at level of ovary, well inside posterior half of body, pre-mouth distance 559–1,011 (737), 63.4–69.1 (65.4)% of body length. Pharynx globular; 48–66 × 47–60 (59 × 55), width 3.82–6.32 (5.00)% of body length. Caecum elongate, 72–450 × 16–44 (351 × 27); length 28.1–44.3 (33.8)% of body length; mostly reaching anterior to pharynx almost to anterior extremity of vitellarium, but with distinct posteriorly directed part overlapping testes, pre-caecal distance 234–706 (452), 27.5–52.6 (38.8)% of body length; caecum to rhynchus distance 164–614 (385).

Testes 2, oval, tandem or nearly so, in posterior quarter of body; pre-testicular distance 573–1,092 (767), 65.0–71.2 (68.0)% of body length; contiguous or slightly separated, distance 0–19 (8), 0–1.99 (0.78)% of body length; anterior testis 44–78 × 42–69 (58 × 53), length 4.74–5.70 (5.11)% of body length; posterior testis 39–86 × 39–61 (60 × 52), length 4.56–6.47 (5.27)% of body length; post-testicular distance 160–283 (216), 16.9–22.2 (19.3)% of body length. Cirrus-sac elongate, more or less parallel sided, reaching to posterior or anterior testis; 125–254 × 33–58 (172 × 43), length 13.2–16.9 (15.3)% of body length; cirrus-sac reach 208–359 (276), 21.7–28.1 (24.7)% of body length. Seminal vesicle subglobular to oval, in proximal cirrus-sac; 26–52 × 23–41 (37 × 32), length 18.9–25.2 (21.4)% of cirrus-sac length. Pars prostatica long, straight, surrounded by dense layer of gland-cells, lined with filaments; 91–195 (127) long, 20–29 (25) wide. Ejaculatory duct narrow, opens on large, lobed genital lobe, inside genital atrium. Genital atrium large. Genital pore ventral, distinctly separated from posterior extremity by 23–42 (34), 2.46–4.16 (3.07)% of body length.

Ovary oval, 41–75 × 35–62 (55 × 45), length 4.19–6.09 (4.84)% of body length; pre-testicular, contiguous with anterior testis; pre-ovarian distance 543–1,030 (724), 61.4–66.7 (64.2)% of body length; post-ovarian distance 245–457 (332), 26.7–32.0 (29.6)% of body length. Mehlis' gland overlaps ovary and anterior testis. Uterine seminal receptacle and Laurer's canal not detected. Uterus not usually reaching anteriorly to vitelline fields, pre-uterine distance 322–853 (514), 33.1–55.2 (45.0)% of body length; uterus to rhynchus distance 254–771 (447), uterus narrow anteriorly to pharynx, wider posteriorly. Eggs numerous, tanned, operculate; 18–25 × 13–19 (22 × 16). Metraterm not detected, obscured by eggs. Vitellarium consists of 2 lateral fields of 14–18 (16) follicles, symmetrical or nearly so, but with one



Figs. 1–2 *Bucephalus damriyasai* n. sp. 1, Holotype, ventral view; 2, Rhynchus with the seven tentacles labelled for clarity. *Scale-bars*: 1, 200 µm; 2, 100 µm

slightly longer than other, long field 180–385 (265) long, 20.3–26.5 (23.3)% of body length; shorter field 168–360 (248) long; anterior extremity usually anterior to uterus and caecum; pre-vitelline distance 359–587 (438), 36.9–42.4 (39.0)% of body length; vitellarium to rhynchus distance 287–504 (363); posterior extremity just anterior to or overlapping pharynx; post-vitelline distance 290–600 (415), 33.5–39.7 (36.9)% of body length.

Excretory pore terminal; anterior extent of vesicle visible in some specimens reaching just anterior to vitellarium.

Discussion

We are aware of 48 described nominal species of *Bucephalus* in marine fishes and we have examined the descriptions of all except *B. arabiana* Varma, 1982, the description of which we have been unable to find. We have developed a visual key similar to that to *Prosorhynchus* developed by Bray & Palm (2009) (http://www.nhm.ac.uk/bray2009). Ten characters are used, most of which are listed as a percentage of body length: 1, Length; 2, Width %; 3, Rhynchus length %; 4, Tentacle number; 5, Pre-vitelline distance %; 6, Pre-uterine distance %; 7, Pre-mouth distance %; 8, Post-testicular distance %; 9, Cirrus-sac reach %; and 10, Egg length.

Eight species have none of the above listed percentage characters more than 10% either more or less than that quoted in the original description or derived from the original illustrations, or are distinctly different in size, tentacle number or egg-size. These are *B. carangis* Yamaguti, 1970; *B. fragilis* Velasquez, 1959; *B. gorgon* (Linton, 1905) (syn. *B. introversus* Manter, 1940); *B. labracis* Paggi & Orecchia, 1965; *B. paraheterotentaculatus* Velasquez, 1959; *B. sphyraenae* Yamaguti, 1952; *B. varicus* Manter, 1940 (usually considered a synonym of *B. margaritae* Ozaki & Ishibashi, 1934); and *B. yamagutii* Gupta & Singh, 1985.

Bucephalus carangis Yamaguti, 1970 is reported from the black jack *Caranx lugubris* Poey and the bluefin trevally *C. melampygus* Cuvier off Hawaii (Yamaguti, 1970; Palm & Bray, 2014). It apparently grows to a much greater size than *B. damriyasai* n. sp. (to 3,500 µm), the rhynchus is smaller (3–5% of body length), and the cirrus-sac is small, not always reaching to the posterior testis (cirrus-sac reach about 18% of body length).

Bucephalus fragilis Velasquez, 1959 is also reported from carangids, the torpedo scad *Megalaspis cordyla* (L.), the doublespotted queenfish *Scomberoides lysan* (Forsskål) and *Caranx* sp. from off the Philippines, the South China Sea and Masirah Bay off Oman in the northern Indian Ocean (Velasquez, 1959; Parukhin, 1966, 1976). In this tiny species (length 660–900 µm), the pre-vitelline distance is short (about 27% of body-length) and the caecum is saccular.

Bucephalus gorgon (Linton, 1905) (syn. *Bucephalus introversus* Manter, 1940) is a widely reported species known only from carangids and mainly from members of the genus *Seriola* in the Pacific, Indian and Atlantic Oceans. It was described by Linton (1905) as *Gasterostomum gorgon* in the yellowtail amberjack *Seriola lalandi* Valenciennes from the North-West Atlantic at Beaufort, North Carolina. Eckmann (1932) placed this species in *Bucephalus*. It was redescribed and illustrated (apparently a badly contracted specimen) by Linton (1940) as *Nannoenterum gorgon* from *S. lalandi* at Woods Hole, Massachusetts. Bartoli et al. (2005) redescribed this species from the greater amberjack *Seriola dumerili* (Risso) off Corsica in the western Mediterranean Sea. They considered *Bucephalus introversus* Manter, 1940, from the crevalle jack *Caranx hippos* (L.), *S. dumerili*, *S. lalandi* and *Seriola* sp. from the eastern Pacific off Mexico and Columbia (Manter, 1940a) as a synonym of *B. gorgon*. Further descriptions and descriptive matter have been given by Oshmarin (1965) from *Seriola* '*nigromaculata*' off Vietnam; Corkum (1967) from *S. dumerili*, and the banded rudderfish *Seriola zonata* (Mitchill) off Louisiana; Fischthal et al. (1982) from *S. dumerili* off Israel in the eastern Mediterranean; and Luque & Oliva (1993) from *S. lalandi* (as *S. mazatlana*) off Antofagasta, Chile. Other hosts recorded are the threadfin jack, *Carangoides otrynter* (Jordan & Gilbert), the white trevally *Pseudocaranx dentex* (Bloch & Schneider) and the Almaco jack *Seriola rivoliana* Cuvier and the distribution includes the Gulf of Mexico and off Canary Islands in the Atlantic, the Balearic Sea in the western Mediterranean, the Gulf of Mannar in the Indian Ocean and the South China Sea and off New South Wales and Victoria, eastern Australia in the Pacific Ocean (Bravo-Hollis & Sogandares-Bernal, 1956; Parukhin, 1966; Nahhas &

Powell, 1971; Parukhin, 1976; Fischthal, 1982; Montero et al., 2002; Gijon-Botella et al., 2007; Hutson et al., 2007). Nolan et al. (2015) used sequences of *B. gorgon* from *S. dumerili* in the Gulf of Mexico to show that the closest sequenced relative is *Prosorhynchoides ovatus* (Linton, 1898).

Linton (1905, p. 364) described the "anterior sucker (i.e. a rhynchus) surrounded by a crown of about eighteen tentacles"; in most cases, the anterior end of his specimens was withdrawn (his figure 241; incorrectly oriented). Linton (1940) redescribed the species with an anterior sucker provided with about 20 tentacles, the specimens being "all macerated". Bartoli et al. (2005) stated that "the rhynchus of *B. gorgon* consists of seven large retractile tentacles, each of them provided with one or two small basal processes". *Bucephalus gorgon* is usually described as much longer and relatively broader than *B. damriyasai* n. sp., the uterus reaches distinctly anterior to the vitellarium. The rhyncheal tentacles appear much more complex in *B. gorgon*, particularly as described by Bartoli et al. (2005).

Bucephalus labracis Paggi & Orecchia, 1965 was originally found in the European seabass, *Dicentrarchus labrax* (L.) in the Tyrrhenian Sea (Paggi & Orecchia, 1965). It has subsequently been reported from the same host off Israel, off the Iberian Peninsula, in the Tunisian and Algerian lagoons and off Sardinia (Fischthal, 1982; Muñoz et al., 1989; Gargouri Ben Abdallah & Maamouri, 2005; Gijon-Botella et al., 2007; Culurgioni et al., 2010; Culurgioni et al., 2014; Brahim Tazi et al., 2016). This species grows to 3,310 µm long, is slightly or distinctly broader with a slightly larger rhynchus, has shorter pre-uterine (about 23–29%) and pre-mouth (about 54–57%) distances. Metacercariae have been reported in the big-scale sand smelt *Atherina boyeri* Risso, the common goby *Pomatoschistus microps* (Krøyer), the black-striped pipefish *Syngnathus abaster* Risso, the leaping mullet *Chelon saliens* (Risso), the golden grey mullet, *C. auratus* (Risso) and the gilthead seabream *Sparus aurata* L. (see Gargouri Ben Abdallah & Maamouri, 2005; Culurgioni et al., 2014; Culurgioni et al., 2015). The first intermediate host is the carpet shell *Tapes decussatus* (L.) (Gargouri Ben Abdallah & Maamouri, 2005). Another species has been described under this name, *Bucephalus labracis* Nisreen Ezz El-Dien, Abdel-Rahman, El-Gawady, Imam & Fahmy, 1990, from the same host species in the Suez Canal at Ismailia, Egypt (Nisreen Ezz El-Dien et al., 1990). The description is poor, but it does not appear to be conspecific with its senior homonym and may not be in this genus.

Bucephalus paraheterotentaculatus Velasquez, 1959 was originally reported in the blackbanded trevally *Seriolina* [as *Seriola*] *nigrofasciata* (Rüppell) from Malabon, Rizai, Luzon Island, Philippines (Velasquez, 1959). It has subsequently been reported in *S. nigrofasciata*, *S. dumerili* and *Seriola* sp. from the South China Sea and Masirah Bay off Oman in the Northern Indian Ocean (Parukhin, 1966, 1976). This species grows to 4,070 µm long, is relatively rather broad (maximum width about 12–13% of length), the rhynchus bears "21 tentacles grouped in multiples of 3 conforming to the basic number of 7", the post-testicular region is about 31% of body length and the cirrus-sac reach is about 36% of body length. The caecum is described as saccular.

Bucephalus sphyraenae Yamaguti, 1952 was originally reported from *Sphyraena* sp. off Makassar, Sulawasi, Indonesia (Yamaguti, 1952). Subsequently it has been reported from the blackfin barracuda *Sphyraena qenie* Klunzinger (as *S. tessera*), the false stonefish *Scorpaenopsis diabolus* (Cuvier), the obtuse barracuda, *Sphyraena obtusata* Cuvier and the yellowstripe barracuda *Sphyraena chrysotaenia* Klunzinger from the Red Sea, off Okinawa, Japan and the Arabian Gulf off Kuwait (Parukhin, 1970; Dyer et al., 1988; Nahhas et al., 2006). This species grows to 2,800 µm, its width is about 12–16% of body length and the uterus reaches anteriorly to the vitellarium. The caecum is claviform and oriented anteriorly.

Bucephalus varicus Manter, 1940 is usually considered one of several synonyms of *B. margaritae* Ozaki & Ishibashi, 1934. A fairly high proportion of records of *Bucephalus* species from carangids are of *B. margaritae* and its synonyms. It was originally described as a furcocercous cercaria from the pearl oyster *Pinctada imbricata* Röding (as *Pinctada imbricata mertensii*) off Japan (Ozaki & Ishibashi, 1934). A series of papers by Sakaguchi (1962, 1964, 1966a, b, 1968) reported on the completion of the life-cycle of this species and concluded that it was conspecific with *B. varicus* Manter, 1940. Manter (1940a) in describing *B. varicus* from "a young specimen of an unidentified species of *Caranx*, or jack" off Bahia Honda, Panama, considered that *B. polymorphus* of Nagaty (1937) from carangids in the Red Sea was a misidentification, as *B. polymorphus*

is a freshwater species. Overstreet (1969) and Velasquez (1975) considered *B. pseudovaricus* Velasquez, 1959 synonymous with *B. varicus.* Bray (1984) also considered that *B. retractilis* Yamaguti, 1959, *B. carangoides* Yamaguti, 1970 and *B. ulua* Yamaguti, 1970 are synonyms of *B. margaritae*. Nahhas et al. (2006) "confirm this synonymy" and described the worm from the cleftbelly trevally *Atropus atropos* (Bloch & Schneider), the largemouth queenfish *Scomberoides commersonnianus* Lacépède, the Malabar trevally *Carangoides malabaricus* (Bloch & Schneider), the whipfin silver-biddy *Gerres filamentosus* Cuvier and the pickhandle barracuda *Sphyraena jello* Cuvier in the Arabian Gulf off Kuwait. Chinchilla et al. (2006) accepted these synonymies, and described the worm from the southern sennet *Sphyraena picudilla* Poey off Venezuela. Marchiori et al. (2010) also accepted the synonymy and described the life-cycle in the brown or South American rock mussel *Perna perna* (L.), the combtooth blenny *Hypleurochilus fissicornis* (Quoy & Gaimard) and the southern kingcroaker *Menticirrhus americanus* (L.) in the waters off Brazil. Many of the more recent records of *B. margaritae* are of non-carangid hosts. Al-Zubaidy (2011) described *B. margaritae* and *B. varicus* as separate species, from the great barracuda *Sphyraena barracuda* (Edwards) and the orange-spotted trevally *Carangoides bajad* (Forsskål), respectively, from Yemeni Red Sea coastal waters off Hodeidah. The illustrations suggest that several species are involved. Nolan et al. (2015) used sequences of worms identified as *B. margaritae* from *Caranx crysos* (Mitchill), from the Gulf of Mexico in their molecular study and showed that, of sequenced species, it is the sister of *B. cynoscion* Hopkins, 1956. *Bucephalus margaritae* differs from *B. damriyasai* n. sp. in its relatively squat shape, short pre-vitelline distance, shorter pre-mouth distance and longer post-testicular distance and cirrus-sac reach. The species has been described many times under the same or different names and clearly needs careful revision. It is likely, if not virtually certain, that a complex of similar species is now known under this name.

Bucephalus yamagutii Gupta & Singh, 1985 is reported only from the Malabar trevally *Carangoides malabaricus* (Bloch & Schneider) (as *Caranx malabaricus*) off the Puri coast in the Bay of Bengal (Gupta & Singh, 1985). It is relatively broad (width about 16% of length), with a relatively short pre-vitelline distance (about 28% of body-length) and the caecum extends anteriorly to the pharynx, but not posteriorly. The rhynchus is said to carry five tentacles.

The features that distinguish marine *Bucephalus* spp. from *B. damriyasai* n. sp. are tabulated in Table 1.

Concluding remarks

It is not clear why we have not been successful in securing useful DNA from this species as it was fixed in the same way as other digeneans recovered from the Bali Workshop that have been successfully sequenced (Cribb et al., 2014; Bray et al., 2016; Yong et al., 2016; Bray et al., 2017). Successful and experienced molecular biologists in the Rostock and the University of Queensland Laboratories have been frustrated in their attempts to extract DNA from these worms. The species described here is morphologically distinct enough to be easily recognised so it was felt worthwhile to describe it and add a further detail to our depauperate knowledge of the marine fish digeneans of Indonesia.

We are aware of eleven named species of bucephalids in Indonesian waters. These are:

- *Bucephalus damriyasai* n. sp. ex blacktip trevally *Caranx heberi* (Carangidae), off Bali.
- *Bucephalus margaritae* Ozaki & Ishibashi, 1934 (as *B. retractilis* Yamaguti, 1952) ex *Caranx* sp. (Carangidae), off Sulawesi (Yamaguti, 1952).
- *Bucephalus sphyraenae* Yamaguti, 1952 ex *Sphyraena* sp. (Sphyraenidae), off Sulawesi (Yamaguti, 1952).
- *Prosorhynchoides tenuis* (Yamaguti, 1952) ex Indian flathead *Platycephalus indicus* (L.) (Platycephalidae), off Sulawesi (Yamaguti, 1952).
- *Prosorhynchus chorinemi* Yamaguti, 1952 ex doublespotted queenfish *Scomberoides lysan* (Forsskål) (Carangidae), off Sulawesi (Yamaguti, 1952).
- *Prosorhynchus longicollis* Yamaguti, 1953 ex *Sphyraena* sp. (Sphyraenidae), off Sulawesi (Yamaguti, 1953).

Table 1 Comparative table of marine *Bucephalus* spp. Bold indicates major distinctions, italics indicates minor distinctions. Column 3: Width %; 4: Rhynchus length %; 6: Pre-vitelline distance %; 7: Pre-uterine distance %; 8: Pre-mouth distance %; 9: Post-testicular distance %; 10: Cirrus-sac reach %

	Length	3	4	Tentacle number	6	7	8	9	10	Eggs	Source
B. damriyasai n. sp.	851–1,544	8–10	6–8	7	37–42	33–55	63–69	17–22	22–28	18–25 × 13–19	Present study
B. anguillae Špakulová, Macko, Berrilli & Dezfuli, 2002	1,118–1,658	**27–29**	*17–18*	7	*21–37*	**16–17**	*54–60*	22–28	34–42	28–30 × 18	Špakulová et al. (2002)
	1,160–2,320	**26–34**	*15–16*	5 (retracted)	*28*	**18**	*57*	15	26	20–34 × 10–18	Gargouri-Ben Abdullah & Maamouri (2002)
B. arabiansis Dwivedi, 2007	1,020–1,530	*17–35*	*10–16*	*5*	**12**	**13**	68	23	**44**	20–30 × 10–30	Dwivedi (2007)
B. baeri Maillard & Saad-Fares, 1981	1,320–2,640	*15–17*	10–13	7	*32*	**17**	45	22	28	24–27 × 14–16	Maillard & Saad-Fares (1981)
B. barina Srivastava, 1938	1,520–2,800	**24–33**	7–9	**5**	**24**	**14**	*55*	**36**	**39**	15–19 × 9–11	Srivastava (1938)
B. binidentacularis Wang, 1977	1,600	**35**	*11*	[? 6]	**15**	**13**	*53*	**38**	**46**	21–25 × 14–16	Wang (1977)
B. brevitentaculatus Corkum, 1967	660–1,330	**28–40**	9–11	7	**15**	**19**	*54*	**37**	**50**	20 × 13	Corkum (1967)
B. carangis Yamaguti, 1970	*1,150–3,500*	10–14	*3–5*	7	34	38	59	22	*18*	17–23 × 11–14	Yamaguti (1970)
B. carangoides Yamaguti, 1970	1,000–1,650	**35–44**	*14–15*	7	**21**	**12**	*56*	**39**	**43**	16–21 × 10–14	Yamaguti (1970)
B. confusus Velasquez, 1959	**2,800**	12.5	4	**20**	?	?	?	?	?	24 × 13–18	Linton (1940)
B. cynoscion Hopkins, 1956	600–1,400	*17–34*	8–16	*5 (or 7)*	**13**	**8**	57	30	32	20–25 × 13–15	Hopkins (1956)
B. elacatus Yadav, 1977	**4,160–5,120**	*13–15*	*2–3*	*4*	36	*25*	*53*	18	23	24–25 × 9–11	Yadav (1977)
B. fischthali Gupta & Tiwari, 1985	**2,520–4,000**	*18–27*	6–8	*6*	**23**	*25*	63–64	21–23	33	32–35 × 32–35	Gupta & Tiwari (1985)
B. fragilis Velasquez, 1959	660–900	*15–26*	6	7	**27**	33	59	27	30	17–18 × 9–13	Velasquez (1959)
B. gorgon (Linton, 1905)	1,562–2,750	7–15	8–12	7	31–45	*17–24*	59–65	18–22	26–28	21–24 × 13–15	Bartoli et al. (2005)
	1,650	**22**	11	**about 18**	29	**45**	?	16	34	22 × 14	Linton (1905)
	2,380–3,130	11–14	7–10	**about 20**	*28*	*8–30*	?	?	?	18–21 × 10–12	Linton (1940)
	2,238	12	9	**22**	33	**17**	59	25	28	?	Corkum (1967)
	2,700	9	9	?	*27*	**21**	60	*31*	25	19–20 × 13–14	Oshmarin (1965)
B. hainanensis Shen, 1990	1,337–2,278	**27–28**	6–7	7	**19**	**17**	*54*	*30*	*34*	15–18 × 9–12	Shen (1990)
B. harpodontis Wang, 1980	1,200–1,600	11	7	8	**22**	34	**44**	26	28	24–26 × 16–18	Wang (1980)
B. heterotentaculatus Bravo-Hollis & Sogandares-Bernal, 1956	**2,080–3,420**	12–13	8–11	7	36	**18**	56–78	24	29	22–28 × 13–17	Bravo-Hollis & Sogandares-Bernal (1956)
B. hexalobatus Bilqees, Khatoon & Haseeb, 2006[a]	**3,790–3,850**	**21–22**	?	?	?	?	?	?	?	20–24 × 17–19	Bilqees et al. (2006)
B. introversus Manter, 1940	1,202–1,707	*17–19*	*14–20*	7	46	30	61	14	*35*	22–26 × 12–15	Manter (1940a)

Table 1 continued

	Length	3	4	Tentacle number	6	7	8	9	10	Eggs	Source
B. introversus Manter, 1940	1,720–2,940	*16*	*3–4*	?	?	?	?	?	?	23 × 17	Luque & Oliva (1993)
B. jagannathai Verma, 1936	1,100–1,700	**32–38**	*11–15*	*6*	**21**	**17**	**51**	24	**43**	19–20 × 12–13	Verma (1936)
B. kaku Yamaguti, 1970	*1,500–4,700*	11–13	6–7	*11*	*53*	*25*	**48**	19	23	21–25 × 12–16	Yamaguti (1970)
B. kanagurtai Gupta & Tiwari, 1985	**3,200–3.570**	**26–27**	7–8	7	**23**	*25*	64–76	*31*	*37*	**40–70 × 40–70 (?)**	Gupta & Tiwari (1985)
B. kathetostomae (Manter, 1934)	688–1,434	**20–49**	12–21	*5*	**19**	26	*39–55*	**42**	**53**	18–20 × 10–11	Manter (1934)
B. labracis Paggi & Orecchia, 1965	*1,980–3,310*	11–14	*10–11*	7	46	*23*	*54*	16	21	20–21 × 18–19	Paggi & Orecchia (1965)
	1,370–2,750	15–18	*10–14*	?	?	?	?	?	?	22–24 × 13–15	Maillard (1976)
	1,200-2,600	**22-30**	*13-15*	7	30	29	*57*	18	?	20-38 x 12-23	Gargouri Ben Abdullah & Maamouri (2005)
B. labracis Nisreen Ezz El-Dien, Abdel-Rahman, El-Gawady, Imam & Fahmy, 1990	*709–727*	**28–29**	*13–21*	**numerous**	41	45	71	19	**45**	19–24 × 9–10	Nisreen Ezz El-Dien et al. (1990)
B. leognathi Velasquez, 1959	*680*	**44**	*13*	*6*	*29*	30	**51**	**39**	*36*	17–18 × 11–13	Velasquez (1959)
B. margaritae Ozaki & Ishibashi, 1934	?	*19*	8	7	**21**	**14**	60	25	30	??	Sakaguchi (1968)
	1,435	*15*	9	7	*48*	*29*	59	15	24	20–22,5 × 10	Chinchilla et al. (2006)
	320–815	*16–20*	*15*	7	42	?	67–69	17	*32*	14–28 × 4(?)–19	Marchiori et al. (2010)
	343–834	*17–20*	9	7	42	*28*	*58*	14	25	19–20 × 8–11	Al-Zubaidy (2011)
B. marinus Vlasenko, 1931	2,000	10	*12*	7?	33	**21**	**40**	*28*	30	24 × 15	Vlasenko (1931)
B. minimus (Stossich, 1887)	900	**72**	*13*	0?	41	44	**35**	**36**	**41**	not given	Stossich (1887)
	840–1,540	**76**	*11–16*	7	**57**	34	**43**	24	**41**	22–24 × 13–14	Maillard (1975, as *Labratrema lamirandi*)
	366–1,088	**51–70**	*10–18*	?	**57**	?	?	?	?	18–24 × 10–15	Pina et al. (2009)
B. neoscombropsi Parukhin, 1979	*2,300–2,860*	17	8–9	7	41	27	**50**	16	26	20–25 × 17–22	Parukhin (1979)
B. paraheterotentaculatus Velasquez, 1959	*1,220–4,070*	12–13	*2–3*	21/3 = 7	40	31	42–71	*31*	*36*	15–26 × 11–18	Velasquez (1959)
B. priacanthi Manter, 1940	1,020–1,215	**21**	*12*	7	**25**	**13**	**51–52**	24	**39**	17–19 × 10–12	Manter (1940b)
B. pseudovaricus Velasquez, 1959	980–1,000	**24–30**	8	weak	36	34	59	24	**43**	18–22 × 13–14	Velasquez (1959)
B. retractilis Yamaguti, 1952	1,400–1,950	**21–23**	7	7	**18**	**16**	*55*	**35**	*37*	15–16 × 10–12	Yamaguti (1952)

Table 1 continued

	Length	3	4	Tentacle number	6	7	8	9	10	Eggs	Source
B. scorpaenae Manter, 1940	*2,065–2,792*	*12–15*	6–7	7	**23**	**15**	**46**	23	28	19–22 × 13–15	Manter (1940b)
B. sebastichthydis Yamaguti, 1959	**3,450**	*13*	10	7	*31*	*25*	**51**	22	23	23–26 × 13–16	Yamaguti (1959)
B. sextentaculatus Yamaguti, 1970	*1,800–3,600*	8–9	8	*6*	38	**7**	63	26	21	16–21 × 11–16	Yamaguti (1970)
B. solitarius Kohn, 1966	1,550	*15*	7	*5*	33	**21**	60	*32*	28	20–22 × 11–13	Kohn (1966)
B. sphyraenae Yamaguti, 1952	*2,500–2,800*	*12–16*	*5*	7	37	*25*	*58*	25	25	18–24 × 12–16	Yamaguti (1952)
	1,500–2,175	*12–15*	*5–6*	7	*29*	**16**	**46**	21	26	13–20 × 10–18	Nahhas et al. (2006)
B. thapari Gupta & Tiwari, 1983	**3,470–3,850**	**25–26**	7–8	*4*	*29*	*29*	68	*28–30*	**39**	16–18 × 16–18	Gupta & Tiwari (1985)
B. trifurcatus Wang, 1980	*2,400–2,480*	10	6	7	**23**	**17**	55	21	21	19–21 × 14–15	Wang (1980)
B. ulua Yamaguti, 1970	650–1,300	**28–43**	*14–15*	7 (rarely 6)	**21**	**19**	63	**35**	**47**	14–21 × 9–14	Yamaguti (1970)
B. uranoscopi Yamaguti, 1934	**4,860**	9	*3*	7	40	41	63	22	*19*	18 × 22	Yamaguti (1934)
B. urophyci Szidat, 1961	760	*13*	*17*	?	*28*	**20**	*55*	25	*37*	19 × 10	Szidat (1961)
B. varicus Manter, 1940	705–1,458	*9–28*	*6–19*	7	**20–25**	*17–31*	*53*	21–49	*35–48*	17–20 × 9–16	Manter (1940a)
	618–2,288	*15–17*	8–14	7	23–38	*25–30*	48–86	22–31	*32–54*	21–27 × 13–23	Nagaty (1937, as *B. polymorphus*)
	1,787–2,338	**21–24**	6–8	7	34	**17**	*58*	24	29	15–20 × 9–18	Shen (1990)
	980–2,500	*12–20*	*9–17*	7	37	**21**	*56*	22	20	17–22 × 11–13.	Al-Zubaidy (2011)
B. xiamenensis Liu, 1994	1,620–2,180	*20–22*	9–11	7	**14**	**9**	**46**	*30*	*34*	18–22 × 12–16	Liu (1994)
B. yamagutii Gupta & Singh, 1985	1,460–1,570	*16*	8	*5*	*28*	*29*	66	24–25	30	15–18 × 9–11	Gupta & Singh (1985)

[a]This species is unrecognisable; the illustrations are poorly reproduced microphotographs

- *Prosorhynchus luzonicus* Velasquez, 1959 ex orange-spotted grouper *Epinephelus coioides* (Hamilton, 1822) (Serranidae), and brown-marbled grouper *E. fuscoguttatus* (Forsskål), off Sumatra and Java (Palm & Rückert, 2009; Rückert et al., 2009; Rückert et al., 2010; Kleinertz & Palm, 2015).
- *Prosorhynchus platycephali* (Yamaguti, 1934) ex fringelip flathead *Sunagocia otaitensis* (Cuvier) (Platycephalidae), off Java (Bray & Palm, 2009).
- *Rhipidocotyle danai* Bray & Palm, 2009 ex black snoek *Thyrsitoides marleyi* Fowler (Gempylidae), off Java (Bray & Palm, 2009).
- *Rhipidocotyle jayai* Bray & Palm, 2009 ex largefin croaker *Johnius macropterus* (Bleeker) (Sciaenidae), off Java (Bray & Palm, 2009).
- *Rhipidocotyle khalili* Nagaty, 1937 ex *Sphyraena* sp. (Sphyraenidae), off Sulawesi (Yamaguti, 1953).

Two further, as yet unnamed, species are found in Indonesian groupers:

- *Prosorhynchus* sp. 1 of Bray & Palm (2009) (syn. *Prosorhynchus australis* of Rückert et al. (2009) and Palm & Rückert (2009)) from *Epinephelus coioides*, off Sumatra, *E. fuscoguttatus*, off Java and the areolate grouper *E. areolatus* (Forsskål), off Java (Palm & Rückert, 2009; Rückert et al., 2009; Rückert et al., 2010; Palm et al., 2011; Kleinertz et al., 2014; Kleinertz & Palm, 2015).
- *Prosorhynchus* sp. 2 of Bray & Palm (2009) (Syn. *Prosorhynchus* cf. *crucibulum* (Rudolphi, 1819) of Palm & Rückert (2009)) ex *Epinephelus fuscoguttatus*, off Java and *E. areolatus*, off Bali (Rückert et al., 2009; Palm et al., 2011; Kleinertz et al., 2014).

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All applicable institutional, national and international guidelines for the care and use of animals were followed.

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6. Declaration of Independence for the Publications

Palm HW*, **Theisen S***, Damriyasa IM, Kusmintarsih ES, Oka IBM, Setyowati EA, Suratma NA, Wibowo S, Kleinertz S (2017) *Anisakis* (Nematoda: Ascaridoidea) from Indonesia. Diseases of Aquatic Organisms 123, 141-157. **Both first authors contributed equally.*

Harry W. Palm: conceptual design of the project idea, sampling, resources, writing, editing

Stefan Theisen: sampling, parasitological examinations, preparation of the fish and parasites, their diagnosis and identification, processing, illustrations and tables, data curation, calculations, writing, editing, correspondence

Indonesian authors: logistics and literature research, laboratory and field work, editing

Sonja Kleinertz: formal analysis, validation, writing, editing

Theisen S, Palm HW, Al-Jufaili SH, Kleinertz S (2017) *Pseudempleurosoma haywardi* sp. nov. (Monogenea: Ancyrocephalidae (*sensu lato*) Bychowsky & Nagibina, 1968): an endoparasite of croakers (Teleostei: Sciaenidae) from Indonesia. PLoS ONE, open access.

Stefan Theisen: conceptual design of the project idea, samplings, parasitological examinations, preparation of the fish and parasites, their diagnosis and identification, processing, formal analysis, illustrations and tables, data curation, calculations, writing, editing, correspondence

Harry W. Palm: resources, writing, editing

Sarah H. Al-Jufaili: confocal microscopy preparations, genetic and phylogenetic analyses, editing

Sonja Kleinertz: formal analysis, validation, writing, editing

Theisen S, Palm HW, Stolz H, Al-Jufaili SH, Kleinertz S (2018) Endoparasitic *Paradiplectanotrema klimpeli* sp. nov. (Monogenea: Ancyrocephalidae): from the Greater lizardfish *Saurida tumbil* (Teleostei: Synodontidae) in Indonesia. Parasitology Open, open access.

Stefan Theisen: conceptual design of the project idea, samplings, parasitological examinations, preparation of the fish and parasites, their diagnosis and identification, processing, formal analysis, illustrations and tables, data curation, calculations, writing, editing, correspondence

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Bray RA, Palm HW, **Theisen S** (**2018**) *Bucephalus damriyasai* sp. nov. (Digenea; Bucephalidae) from the Blacktip trevally, *Caranx heberi* (Bennett, 1830) (Perciformes: Carangidae) from Bali, Indonesia. Systematic Parasitology, open access.

Rodney A. Bray: conceptual design of the project idea, sampling (on workshop), parasitological examinations, preparation of the fish and parasites, their diagnosis and identification, processing, illustrations and tables, data curation, calculations, writing, editing, correspondence

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7. Independence Declaration for the Dissertation

I hereby declare on oath that the opportunity for the present doctoral project has not been communicated to me commercially. In particular, I did not involve any organization that seeks supervisors for the preparation of dissertations for a fee, or who performs all or part of the duties incumbent upon me with regard to examinations.

I hereby declare on oath that I have prepared the present work independently and have written it unaided. For this I have used no other than the tools and sources I have specified, and I have identified the used works and references in terms and content literally places as such.

Rostock, 2019

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Stefan Theisen

8. Vitae Cursus

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My biggest thanks go to my family, my parents Monika and Werner, my grandmother Ursula and my grandfather Karl-Heinz (†), and my wife Janine. Thank you for always believing in me, sacrificing time and providing unconditional support. Without you and your backing, this work would not have been possible. Thank you very much! I love you!

10. Appendix I.1: Annotated Checklist of Indonesian Marine Fish Parasites with Hosts (Free-Living Actinopterygii) and References

Host order	Host family	Host species	Parasite group	Parasite family	Parasite species	Site	Reference
Anguilliformes	Congridae	*Conger cinereus* Rüppell, 1830	Cestoda	Eutetrarhynchidae	*Oncomegas javensis* Palm, 2004	intestine	Palm 2004
Anguilliformes	Congridae	*Conger cinereus* Rüppell, 1830	Cestoda	Lacistorhynchidae	*Grillotia (Christianella) yuniariae* Palm, 2004	liver	Palm 2004
Anguilliformes	Congridae	*Conger cinereus* Rüppell, 1830	Cestoda	Tentaculariidae	*Nybelinia africana* Dollfus, 1960	intestine	Palm 2004
Anguilliformes	Congridae	*Conger cinereus* Rüppell, 1830	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	intestine	Palm 2004
Atheriniformes	Atherinidae	*Atherinomorus lacunosus* (Forster, 1801	Crustacea: Copepoda	Pennellidae	*Peniculus communis* Leigh-Sharpe, 1934	fins	Leigh-Sharpe 1934
Atheriniformes	Atherinidae	*Hypoatherina temminckii* (Bleeker, 1853)	Crustacea: Isopoda	Cymothoidae	*Elthusa/Mothocya* sp.	gills	Bruce 1988
Atheriniformes	Atherinidae	*Hypoatherina temminckii* (Bleeker, 1853)	Crustacea: Isopoda	Cymothoidae	*Elthusa/Mothocya* sp.	gills	Trilles 1979
Aulopiformes	Alepisauridae	*Alepisaurus ferox* Lowe, 1833	Cestoda	Sphyriocephalidae	*Sphyriocephalus dollfusi* (Bussieras & Aldrin, 1968)	stomach wall	Jakob & Palm 2006
Aulopiformes	Alepisauridae	*Alepisaurus ferox* Lowe, 1833	Cestoda	Sphyriocephalidae	*Sphyriocephalus dollfusi* (Bussieras & Aldrin, 1968)	stomach wall	Jakob 2005
Aulopiformes	Alepisauridae	*Alepisaurus ferox* Lowe, 1833	Cestoda	Sphyriocephalidae	*Sphyriocephalus dollfusi* (Bussieras & Aldrin, 1968)	stomach	Palm 2004
Aulopiformes	Alepisauridae	*Alepisaurus ferox* Lowe, 1833	Cestoda	Tentaculariidae	*Myxonybelinia lepturi* Palm, 2004	nr	Jakob & Palm 2006
Aulopiformes	Alepisauridae	*Alepisaurus ferox* Lowe, 1833	Cestoda	Tentaculariidae	*Myxonybelinia lepturi* Palm, 2004	nr	Jakob 2005
Aulopiformes	Alepisauridae	*Alepisaurus ferox* Lowe, 1833	Cestoda	Tentaculariidae	*Myxonybelinia lepturi* Palm, 2004	body cavity	Palm 2004
Aulopiformes	Alepisauridae	*Alepisaurus ferox* Lowe, 1833	Cestoda	Tentaculariidae	*Nybelinia africana* Dollfus, 1960	stomach wall	Jakob & Palm 2006
Aulopiformes	Alepisauridae	*Alepisaurus ferox* Lowe, 1833	Cestoda	Tentaculariidae	*Nybelinia africana* Dollfus, 1960	stomach wall	Jakob 2005
Aulopiformes	Alepisauridae	*Alepisaurus ferox* Lowe, 1833	Cestoda	Tentaculariidae	*Nybelinia africana* Dollfus, 1960	body cavity	Palm 2004
Aulopiformes	Alepisauridae	*Alepisaurus ferox* Lowe, 1833	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	musculature	Jakob & Palm 2006
Aulopiformes	Alepisauridae	*Alepisaurus ferox* Lowe, 1833	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	musculature	Jakob 2005
Aulopiformes	Alepisauridae	*Alepisaurus ferox* Lowe, 1833	Cestoda	Tentaculariidae	Tentaculariidae indet.	stomach wall	Jakob & Palm 2006
Aulopiformes	Alepisauridae	*Alepisaurus ferox* Lowe, 1833	Cestoda	Tentaculariidae	Tentaculariidae indet.	stomach wall	Jakob 2005
Aulopiformes	Synodontidae	*Saurida gracilis* (Quoy & Gaimard, 1824)	Crustacea: Copepoda	Caligidae	*Abasia inflata* Cressey & Cressey, 1979	gills	Cressey & Cressey 1979
Aulopiformes	Synodontidae	*Saurida gracilis* (Quoy & Gaimard, 1824)	Nematoda	Anisakidae	Anisakidae indet. (cf. *Hysterothylacium* sp.)	body cavity	Yamaguti 1954c
Aulopiformes	Synodontidae	*Saurida isarankurai* Shinda & Yamada, 1972	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1983
Aulopiformes	Synodontidae	*Saurida isarankurai* Shinda & Yamada, 1972	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm & Theisen et al. 2017
Aulopiformes	Synodontidae	*Saurida isarankurai* Shinda & Yamada, 1972	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm et al. 2008
Aulopiformes	Synodontidae	*Saurida longimanus* Norman, 1939	Cestoda	Bothriocephalidae	*Oncodiscus sauridae* Yamaguti, 1934	intestine	Kuchta et al. 2009
Aulopiformes	Synodontidae	*Saurida longimanus* Norman, 1939	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1983
Aulopiformes	Synodontidae	*Saurida longimanus* Norman, 1939	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm & Theisen et al. 2017
Aulopiformes	Synodontidae	*Saurida longimanus* Norman, 1939	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm et al. 2008
Aulopiformes	Synodontidae	*Saurida micropectoralis* Shinda & Yamada, 1972	Cestoda	Bothriocephalidae	*Penetrocephalus ganapattii* (Rao, 1954) Rao, 1960	intestine	Kuchta et al. 2009
Aulopiformes	Synodontidae	*Saurida micropectoralis* Shinda & Yamada, 1972	Cestoda	Lacistorhynchidae	Lacistorhynchidae indet.	body cavity	Palm 2004
Aulopiformes	Synodontidae	*Saurida micropectoralis* Shinda & Yamada, 1972	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1983
Aulopiformes	Synodontidae	*Saurida micropectoralis* Shinda & Yamada, 1972	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm & Theisen et al. 2017
Aulopiformes	Synodontidae	*Saurida micropectoralis* Shinda & Yamada, 1972	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm et al. 2008
Aulopiformes	Synodontidae	*Saurida tumbil* (Bloch, 1795)	Cestoda	Bothriocephalidae	*Oncodiscus sauridae* Yamaguti, 1934	intestine	Kuchta et al. 2009
Aulopiformes	Synodontidae	*Saurida tumbil* (Bloch, 1795)	Cestoda	Bothriocephalidae	*Penetrocephalus ganapattii* (Rao, 1954) Rao, 1960	intestine	Kuchta et al. 2009

Aulopiformes	Synodontidae	*Saurida tumbil* (Bloch, 1795)	Cestoda	Lacistorhynchidae	*Grillotia (Christianella) yuniariae* Palm, 2004	liver	Palm 2004
Aulopiformes	Synodontidae	*Saurida tumbil* (Bloch, 1795)	Digenea	Hemiuridae	*Plerurus digitatus* (Looss, 1899) Looss, 1907	stomach	Yamaguti 1953b
Aulopiformes	Synodontidae	*Saurida tumbil* (Bloch, 1795)	Digenea	Hemiuridae	*Tubulovesicula angusticuada* (Nicoll, 1915)	stomach	Yamaguti 1953b
Aulopiformes	Synodontidae	*Saurida tumbil* (Bloch, 1795)	Monogenea	Ancyrocephalidae	*Paradiplectanotrema klimpeli* Theisen et al. 2018	oesophagus	Theisen et al. 2018
Aulopiformes	**Synodontidae**	***Saurida tumbil* (Bloch, 1795)**	**Nematoda**	**Anisakidae**	***Anisakis* sp.[30]**	**mesenteries**	**Present study**
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Acanthocephala	Rhadinorhynchidae	*Gorgorhynchus* sp.	pyloric caeca	Tobing 2000
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Tobing 2000
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Cestoda	Bothriocephalidae	*Bothriocephalus* sp.	intestine	Tobing 2000
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Cestoda	Bothriocephalidae	*Oncodiscus sauridae* Yamaguti, 1934	intestine	Kuchta et al. 2009
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Cestoda	Lacistorhynchidae	*Grillotia* sp.	intestine	Tobing 2000
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus* sp.	gills	Tobing 2000
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Tobing 2000
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Digenea	Bivesiculidae	*Bivesicula* sp.[2]	stomach wall	Tobing 2000
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1983
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm & Theisen et al. 2017
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm et al. 2008
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Tobing 2000
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Tobing 2000
Aulopiformes	Synodontidae	*Saurida undosquamis* (Richardson, 1848)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.[28]	body cavity	Tobing 2000
Aulopiformes	Synodontidae	*Synodus englemani* Schultz, 1953	Crustacea: Copepoda	Caligidae	*Abasia pillaii* Cressey & Cressey, 1979	gills	Cressey & Cressey 1979
Aulopiformes	Synodontidae	*Synodus englemani* Schultz, 1953	Crustacea: Copepoda	Taeniacanthidae	*Metataeniacanthus epigri* Cressey & Cressey, 1979	gills	Cressey & Cressey 1979
Aulopiformes	Synodontidae	*Synodus* sp.	Crustacea: Copepoda	Taeniacanthidae	*Metataeniacanthus indiscretus* Cressey & Cressey 1979	gills	Cressey & Cressey 1979
Aulopiformes	Synodontidae	*Synodus usitatus* Cressey, 1981	Crustacea: Copepoda	Taeniacanthidae	*Metataeniacanthus* sp.	nr	Dojiri & Cressey 1987
Aulopiformes	Synodontidae	*Synodus variegatus* (Lacépède, 1803)	Crustacea: Copepoda	Taeniacanthidae	*Metataeniacanthus vulgaris* Cressey & Cressey 1979	gills	Cressey & Cressey 1979
Beloniformes	**Belonidae**	***Ablennes hians* (Valenciennes, 1846)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**guts**	**Present study, workshop Bali**
Beloniformes	**Belonidae**	***Ablennes hians* (Valenciennes, 1846)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**guts**	**Present study, workshop Bali**
Beloniformes	Belonidae	*Ablennes hians* (Valenciennes, 1846)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Palm 2004
Beloniformes	Belonidae	*Ablennes hians* (Valenciennes, 1846)	Crustacea: Branchiura	Argulidae	*Argulus belones* van Kampen, 1909	surface	van Kampen 1909
Beloniformes	Belonidae	*Ablennes hians* (Valenciennes, 1846)	Crustacea: Copepoda	Bomolochidae	*Bomolochus bellones* Burmeister, 1833	upper oral valve	Cressey & Collette 1970
Beloniformes	Belonidae	*Ablennes hians* (Valenciennes, 1846)	Crustacea: Copepoda	Bomolochidae	*Bomolochus sinensis* (Cressey, 1970)	upper oral valve	Cressey & Collette 1970
Beloniformes	Belonidae	*Ablennes hians* (Valenciennes, 1846)	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus gibber* (Shiino, 1957)	nr	Cressey & Collette 1970
Beloniformes	**Belonidae**	***Ablennes hians* (Valenciennes, 1846)**	**Crustacea: Copepoda**	**Bomolochidae**	***Nothobomolochus* sp.**	**gills**	**Present study, workshop Bali**
Beloniformes	Belonidae	*Ablennes hians* (Valenciennes, 1846)	Crustacea: Copepoda	Caligidae	*Caligus* sp.	gill cavity	Cressey & Collette 1970
Beloniformes	**Belonidae**	***Ablennes hians* (Valenciennes, 1846)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**gill cavity**	**Present study, workshop Bali**
Beloniformes	**Belonidae**	***Ablennes hians* (Valenciennes, 1846)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropinus* sp.**	**gills**	**Present study, workshop Bali**
Beloniformes	Belonidae	*Ablennes hians* (Valenciennes, 1846)	Crustacea: Copepoda	Pennellidae	*Lernaeenicus* sp.	ventral fins	Leigh-Sharpe 1934
Beloniformes	Belonidae	*Strongylura incisa* (Valenciennes, 1846)	Crustacea: Iopoda	Cymothoidae	*Mothocya renardi* (Bleeker, 1857)	nr	Bruce 1986
Beloniformes	Belonidae	*Strongylura incisa* (Valenciennes, 1846)	Crustacea: Iopoda	Cymothoidae	*Mothocya renardi* (Bleeker, 1857)	nr	Kensley 2001
Beloniformes	Belonidae	*Strongylura leiura* (Bleeker, 1850)	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus digitatus* Cressey, 1970	nr	Cressey & Collette 1970
Beloniformes	Belonidae	*Strongylura leiura* (Bleeker, 1850)	Crustacea: Iopoda	Cymothoidae	*Mothocya renardi* (Bleeker, 1857)	nr	Bruce 1986

Beloniformes	Belonidae	*Strongylura leiura* (Bleeker, 1850)	Crustacea: Iopoda	Cymothoidae	*Mothocya renardi* (Bleeker, 1857)	nr	Kensley 2001
Beloniformes	Belonidae	*Strongylura leiura* (Bleeker, 1850)	Crustacea: Iopoda	Cymothoidae	*Mothocya renardi* (Bleeker, 1857)	nr	Sidabalok 2013
Beloniformes	Belonidae	*Strongylura* sp.	Crustacea: Copepoda	Caligidae	*Caligodes laciniatus* (Krøyer, 1863)	nr	Cressey & Collette 1970
Beloniformes	Belonidae	*Strongylura* sp.	Crustacea: Copepoda	Caligidae	*Caligodes laciniatus* (Krøyer, 1863)	nr	Heller 1865
Beloniformes	Belonidae	*Strongylura* sp.	Crustacea: Copepoda	Caligidae	*Caligodes laciniatus* (Krøyer, 1863)	nr	Krøyer 1863
Beloniformes	**Belonidae**	***Tylosurus acus melanotus* (Bleeker, 1850**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus tylosuri* Richiardi, 1880**	**gills**	**Present study, workshop Bali**
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Jakob & Palm 2006
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Jakob 2005
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Cestoda	Otobothriidae	*Otobothrium alexanderi* Palm, 2004	eye muscle	Palm 2004
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Cestoda	Otobothriidae	*Otobothrium penetrans* Linton, 1907	musculature	Jakob & Palm 2006
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Cestoda	Otobothriidae	*Otobothrium penetrans* Linton, 1907	musculature	Jakob 2005
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Cestoda	Otobothriidae	*Otobothrium penetrans* Linton, 1907	musculature	Palm 2000
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Cestoda	Otobothriidae	*Otobothrium penetrans* Linton, 1907	musculature	Palm 2000
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Cestoda	Otobothriidae	*Otobothrium penetrans* Linton, 1907	musculature	Palm 2004
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Crustacea: Copepoda	Caligidae	*Caligodes laciniatus* (Krøyer, 1863)	gills	Jakob & Palm 2006
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Crustacea: Copepoda	Caligidae	*Caligodes laciniatus* (Krøyer, 1863)	gills	Jakob 2005
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus tylosuri* Richiardi, 1880	gills	Cressey & Collette 1970
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus tylosuri* Richiardi, 1880	gills	Jakob & Palm 2006
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus tylosuri* Richiardi, 1880	gills	Jakob 2005
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Crustacea: Copepoda	Philichthyidae	*Colobomatus goodingi* Cressey & Collette, 1970	lateral line canal	Cressey & Collette 1970
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Nematoda	Philometridae	*Philometroides indonesiensis* Moravec, Walter & Yuniar 2012	musculature	Dewi & Palm 2013
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Nematoda	Philometridae	*Philometroides indonesiensis* Moravec, Walter & Yuniar 2012	musculature	Jakob & Palm 2006
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Nematoda	Philometridae	*Philometroides indonesiensis* Moravec, Walter & Yuniar 2012	musculature	Jakob 2005
Beloniformes	Belonidae	*Tylosurus crocodilus crocodilus* (Péron & Lesueur, 1821)	Nematoda	Philometridae	*Philometroides indonesiensis* Moravec, Walter & Yuniar 2012	musculature	Moravec et al. 2012
Beloniformes	Belonidae	*Tylosurus punctulatus* (Günther, 1872)	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus digitatus* Cressey, 1970	nr	Cressey & Collette 1970
Beloniformes	Belonidae	*Tylosurus* sp.	Crustacea: Copepoda	Caligidae	*Caligodes laciniatus* (Krøyer, 1863)	nr	Heller 1865
Beloniformes	Belonidae	*Tylosurus* sp.	Crustacea: Copepoda	Caligidae	*Caligodes laciniatus* (Krøyer, 1863)	nr	Krøyer 1863
Beloniformes	**Exocoetidae**	***Cheilopogon atrisignis* (Jenkins, 1903)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**guts**	**Present study, workshop Bali**
Beloniformes	**Exocoetidae**	***Cheilopogon atrisignis* (Jenkins, 1903)**	**Cestoda**	**Bothriocephalidae**	**Botriocephalidae indet.**	**guts**	**Present study, workshop Bali**
Beloniformes	**Exocoetidae**	***Cheilopogon atrisignis* (Jenkins, 1903)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet.**	**body cavity**	**Present study, workshop Bali**
Beloniformes	**Exocoetidae**	***Cheilopogon atrisignis* (Jenkins, 1903)**	**Myxozoa: Myxosporea**	**Myxidiidae**	***Myxidium* sp.**	**gallbladder**	**Present study, workshop Bali**
Beloniformes	Exocoetidae	*Cheilopogon atrisignis* (Jenkins, 1903)	Nematoda	Philometridae	Philometridae indet.	mesenteries	Dewi & Palm 2017, workshop
Beloniformes	**Exocoetidae**	***Cheilopogon atrisignis* (Jenkins, 1903)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**mesenteries**	**Present study, workshop Bali**
Beloniformes	**Exocoetidae**	***Cheilopogon intermedius* Parin, 1961**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**intestine**	**Present study, workshop Bali**
Beloniformes	Exocoetidae	*Cypselurus ophistopus* (Bleeker, 1865)	Crustacea: Copepoda	Pennellidae	*Peniculus communis* Leigh-Sharpe, 1934	fins	Leigh-Sharpe 1934
Beloniformes	Exocoetidae	*Paraexocoetus brachypterus* (Richardson, 1846)	Crustacea: Iopoda	Cymothoidae	Cymotoidae indet.	nr	Trilles 1979

Beloniformes	Hemiramphidae	*Hemiramphus far* (Forsskål, 1775)	Crustacea: Iopoda	Cymothoidae	*Ceratothoa retusa* (Schiødte & Meinert, 1883)	mouth	Bruce & Bowman 1989
Beloniformes	Hemiramphidae	*Hemiramphus far* (Forsskål, 1775)	Crustacea: Iopoda	Cymothoidae	*Ceratothoa retusa* (Schiødte & Meinert, 1883)	mouth	Sidabalok 2013
Beloniformes	Hemiramphidae	*Hemiramphus far* (Forsskål, 1775)	Crustacea: Iopoda	Cymothoidae	*Mothocya plagulophora* (Haller, 1880)	nr	Bruce 1986
Beloniformes	Hemiramphidae	*Hemiramphus far* (Forsskål, 1775)	Crustacea: Iopoda	Cymothoidae	*Mothocya plagulophora* (Haller, 1880)	nr	Kensley 2001
Beloniformes	Hemiramphidae	*Hyporhamphus dussumieri* (Valenciennes, 1847)	Crustacea: Iopoda	Cymothoidae	*Ceratothoa angulata* (Richardson, 1910)	mouth	Bruce & Bowman 1989
Beloniformes	Hemiramphidae	*Hyporhamphus dussumieri* (Valenciennes, 1847)	Crustacea: Iopoda	Cymothoidae	*Ceratothoa angulata* (Richardson, 1910)	mouth	Hadfield et al. 2016
Beloniformes	Hemiramphidae	*Zenarchopterus buffonis* (Valenciennes, 1847)	Crustacea: Iopoda	Cymothoidae	*Elthusa/Mothocya* sp.	gill cavity	Bruce 1988
Beloniformes	Hemiramphidae	*Zenarchopterus buffonis* (Valenciennes, 1847)	Crustacea: Iopoda	Cymothoidae	*Elthusa/Mothocya* sp.	gill cavity	Monod & Serène 1976
Beloniformes	Hemiramphidae	*Zenarchopterus buffonis* (Valenciennes, 1847)	Crustacea: Iopoda	Cymothoidae	*Elthusa/Mothocya* sp.	gill cavity	Monod 1976
Beryciformes	Holocentridae	*Sargocentron cornutum* (Bleeker, 1853)	Crustacea: Iopoda	Cymothoidae	*Agarna cumulus* (Haller, 1880)	nr	Sidabalok 2013
Beryciformes	Holocentridae	*Sargocentron cornutum* (Bleeker, 1853)	Crustacea: Iopoda	Cymothoidae	*Agarna cumulus* (Haller, 1880)	nr	Trilles 1979
Beryciformes	Holocentridae	*Sargocentron cornutum* (Bleeker, 1853)	Crustacea: Iopoda	Cymothoidae	*Agarna cumulus* (Haller, 1880)	nr	Schiødte & Meinert 1879-1884
Beryciformes	Trachichthyidae	*Gephyroberyx darwinii* (Johnson, 1866)	Cestoda	Lacistorhynchidae	*Grillotia (Christianella) yuniariae* Palm, 2004	liver	Palm 2004
Beryciformes	Trachichthyidae	*Gephyroberyx darwinii* (Johnson, 1866)	Myxozoa: Myxosporea	Sphaerosporidae	*Sphaeromyxa limocapitis* Bartošová-Sojková et al., 2015	gallbladder	Bartošová-Sojková et al. 2015
Clupeiformes	Chirocentridae	*Chirocentrus dorab* (Forsskål, 1775)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	liver	Palm 2004
Clupeiformes	**Chirocentridae**	***Chirocentrus dorab* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**body wash**	**Present study, workshop Bali**
Clupeiformes	**Chirocentridae**	***Chirocentrus dorab* (Forsskål, 1775)**	**Digenea**	**Acanthocolpidae**	***Acanthocolpus* sp.**	**guts**	**Present study, workshop Bali**
Clupeiformes	**Chirocentridae**	***Chirocentrus dorab* (Forsskål, 1775)**	**Digenea**	**Acanthocolpidae**	***Stephanostomoides* sp.**	**guts**	**Present study, workshop Bali**
Clupeiformes	**Chirocentridae**	***Chirocentrus dorab* (Forsskål, 1775)**	**Digenea**	**nr**	**Digenea indet.**	**heart**	**Present study, workshop Bali**
Clupeiformes	Clupeidae	*Amblygaster clupeoides* Bleeker, 1849	Digenea	Hemiuridae	*Aphanurus stossichii* (Monticelli, 1891)	stomach	Yamaguti 1953b
Clupeiformes	Clupeidae	*Amblygaster clupeoides* Bleeker, 1849	Digenea	Hemiuridae	*Parahemiurus clupeae* Yamaguti, 1953	stomach	Yamaguti 1953b
Clupeiformes	Clupeidae	*Amblygaster clupeoides* Bleeker, 1850	Digenea	Sclerodistomidae	*Prosogonotrema bilabiatum* Vigueras, 1940	stomach	Yamaguti 1952
Clupeiformes	**Clupeidae**	***Amblygaster sirm* (Walbaum, 1792)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**on intestine**	**Present study**
Clupeiformes	**Clupeidae**	***Amblygaster sirm* (Walbaum, 1792)**	**Cestoda**	**Lacistorhynchidae**	**cf. *Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931**	**on swimbladder**	**Present study**
Clupeiformes	**Clupeidae**	***Amblygaster sirm* (Walbaum, 1792)**	**Crustacea: Copepoda**	**Bomolochidae**	***Pumiliopsis plautus* Cressey & Boyle, 1973**	**gills**	**Present study**
Clupeiformes	**Clupeidae**	***Amblygaster sirm* (Walbaum, 1792)**	**Crustacea: Iopoda**	**(Cymothooidea)**	**Cymothooidea indet.**	**gill cavity**	**Present study**
Clupeiformes	**Clupeidae**	***Amblygaster sirm* (Walbaum, 1792)**	**Digenea**	**Hemiuridae**	***Parahemiurus* cf. *clupeae* Yamaguti, 1953**	**stomach**	**Present study**
Clupeiformes	**Clupeidae**	***Amblygaster sirm* (Walbaum, 1792)**	**Digenea**	**nr**	**Digenea indet. spp. (four species/morphotypes)**	**stomach**	**Present study**
Clupeiformes	**Clupeidae**	***Amblygaster sirm* (Walbaum, 1792)**	**Digenea**	**nr**	**Digenea indet. spp. (two species/morphotypes)**	**on swimbladder**	**Present study**
Clupeiformes	Clupeidae	*Amblygaster sirm* (Walbaum, 1792)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1983
Clupeiformes	Clupeidae	*Amblygaster sirm* (Walbaum, 1792)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Hadidjaja et al. 1978
Clupeiformes	Clupeidae	*Amblygaster sirm* (Walbaum, 1792)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Hutomo et al. 1978
Clupeiformes	Clupeidae	*Amblygaster sirm* (Walbaum, 1792)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Martosewojo 1980
Clupeiformes	Clupeidae	*Amblygaster sirm* (Walbaum, 1792)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm & Theisen et al. 2017
Clupeiformes	Clupeidae	*Amblygaster sirm* (Walbaum, 1792)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm et al. 2008
Clupeiformes	Clupeidae	*Amblygaster sirm* (Walbaum, 1792)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Hadidjaja et al. 1978
Clupeiformes	Clupeidae	*Amblygaster sirm* (Walbaum, 1792)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Hutomo et al. 1978
Clupeiformes	Clupeidae	*Amblygaster sirm* (Walbaum, 1792)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Martosewojo 1980
Clupeiformes	**Clupeidae**	***Amblygaster sirm* (Walbaum, 1792)**	**Nematoda**	**Anisakidae**	***Terranova* sp.**	**body cavity**	**Present study**
Clupeiformes	Clupeidae	*Anodontostoma chacunda* (Hamilton, 1822)	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus* sp.	gills	Theisen 2009

Clupeiformes	Clupeidae	*Anodontostoma chacunda* (Hamilton, 1822)	Crustacea: Copepoda	Bomolochidae	*Pseudorbitacolax varunae* (Bennet, 1966)	eyes	Cressey & Cressey 1980b
Clupeiformes	Clupeidae	*Anodontostoma chacunda* (Hamilton, 1822)	Digenea	(Hemiuroidea)	Hemiuroidea indet.	body cavity	Theisen 2009
Clupeiformes	Clupeidae	*Anodontostoma chacunda* (Hamilton, 1822)	Digenea	Hemiuridae	*Genolinea* sp.	stomach	Theisen 2009
Clupeiformes	Clupeidae	*Anodontostoma chacunda* (Hamilton, 1822)	Monogenea	Mazocraeidae	*Mazocraeoides georgei* Price, 1936	gills	Theisen 2009
Clupeiformes	Clupeidae	*Herklotsichthys quadrimaculatus* (Rüpell, 1837)	Crustacea: Copepoda	Pennellidae	*Peniculus communis* Leigh-Sharpe, 1934	nr (fins)	Leigh-Sharpe 1934
Clupeiformes	**Clupeidae**	***Nematalosa come* (Richardson, 1846)**	**Crustacea: Copepoda**	**Bomolochidae**	**Bomolochidae indet.**	**gills**	**Present study**
Clupeiformes	**Clupeidae**	***Nematalosa come* (Richardson, 1846)**	**Crustacea: Copepoda**	**Caligidae**	**Caligidae indet.**	**gills**	**Present study**
Clupeiformes	**Clupeidae**	***Nematalosa come* (Richardson, 1846)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus* sp.**	**gills**	**Present study**
Clupeiformes	**Clupeidae**	***Nematalosa come* (Richardson, 1846)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study**
Clupeiformes	**Clupeidae**	***Nematalosa come* (Richardson, 1846)**	**Monogenea**	**(Polyopsisthocotylea)**	**Polyopsisthocotylea indet. spp. (three species/morphotypes)**	**gills**	**Present study**
Clupeiformes	Clupeidae	*Sardinella albella* (Valencienne, 1847)	Crustacea: Copepoda	Bomolochidae	*Pumiliopsis sardinellae* (Bennet, 1964)	eyes	Cressey & Cressey 1980b
Clupeiformes	Clupeidae	*Sardinella fimbriata* (Valenciennes, 1847)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1983
Clupeiformes	Clupeidae	*Sardinella fimbriata* (Valenciennes, 1847)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm & Theisen et al. 2017
Clupeiformes	Clupeidae	*Sardinella fimbriata* (Valenciennes, 1847)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm et al. 2008
Clupeiformes	**Clupeidae**	***Sardinella gibbosa* (Bleeker, 1849)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**guts**	**Present study, workshop Bali**
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Cestoda	nr	Cestoda indet.	pyloric caeca	Rückert 2006
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Cestoda	nr	Cestoda indet.	pyloric caeca	Rückert et al. 2009b
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Crustacea: Copepoda	Bomolochidae	*Pumiliopes squamosus* Cressy & Boyle 1973	eyes	Cressey & Cressey 1980b
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Crustacea: Copepoda	Bomolochidae	*Pumiliopes squamosus* Cressy & Boyle 1973	eyes	Rückert 2006
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Crustacea: Copepoda	Bomolochidae	*Pumiliopes squamosus* Cressy & Boyle 1973	eyes	Rückert et al. 2009b
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Crustacea: Iopoda	Cymothoidae	*Nerocila phaiopleura* Bleeker, 1857	surface	Bleeker 1857
Clupeiformes	**Clupeidae**	***Sardinella gibbosa* (Bleeker, 1849)**	**Digenea**	**Faustulidae**	***Pronoprymna* (*Pseudopentagramma*) sp.**	**guts**	**Present study, workshop Bali**
Clupeiformes	**Clupeidae**	***Sardinella gibbosa* (Bleeker, 1849)**	**Digenea**	**Fellodistomidae**	**Fellodistomidae indet.**	**guts**	**Present study, workshop Bali**
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Digenea	Hemiuridae	*Aphanurus* sp.	stomach	Rückert 2006
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Digenea	Hemiuridae	*Aphanurus* sp.	stomach	Rückert et al. 2009b
Clupeiformes	**Clupeidae**	***Sardinella gibbosa* (Bleeker, 1849)**	**Digenea**	**Hemiuridae**	***Aphanurus* sp.**	**stomach**	**Present study, workshop Bali**
Clupeiformes	**Clupeidae**	***Sardinella gibbosa* (Bleeker, 1849)**	**Digenea**	**Hemiuridae**	***Lecithochirium* sp.**	**guts**	**Present study, workshop Bali**
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Digenea	nr	Digenea indet.	intestine	Rückert 2006
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Digenea	nr	Digenea indet.	intestine	Rückert et al. 2009b
Clupeiformes	**Clupeidae**	***Sardinella gibbosa* (Bleeker, 1849)**	**Monogenea**	**(Polyopsisthocotylea)**	**Polyopsisthocotylea indet. spp. (two species/morphotypes)**	**guts**	**Present study, workshop Bali**
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Monogenea	Mazocraeidae	*Mazocraeoides prashadi* Chauhan, 1950	gills	Rückert 2006
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Monogenea	Mazocraeidae	*Mazocraeoides prashadi* Chauhan, 1950	gills	Rückert et al. 2009b
Clupeiformes	**Clupeidae**	***Sardinella gibbosa* (Bleeker, 1849)**	**Myxozoa: Myxosporea**	**Kudoidae**	***Kudoa* sp.**	**musculature**	**Present study, workshop Bali**
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Ilahude 1980
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Ilahude et al. 1978
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm & Theisen et al. 2017
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm et al. 2008
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Rückert 2006
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Rückert et al. 2009b
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Nematoda	nr	Nematoda indet.	pyloric caeca	Rückert 2006

Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Nematoda	nr	Nematoda indet.	pyloric caeca	Rückert et al. 2009b
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	pyloric caeca	Rückert 2006
Clupeiformes	Clupeidae	*Sardinella gibbosa* (Bleeker, 1849)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	pyloric caeca	Rückert et al. 2009b
Clupeiformes	Clupeidae	*Sardinella jussieu* (Lacepède, 1803)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Ilahude 1980
Clupeiformes	Clupeidae	*Sardinella jussieu* (Lacepède, 1803)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Ilahude et al. 1978
Clupeiformes	Clupeidae	*Sardinella jussieu* (Lacepède, 1803)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm & Theisen et al. 2017
Clupeiformes	Clupeidae	*Sardinella jussieu* (Lacepède, 1803)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm et al. 2008
Clupeiformes	Clupeidae	*Sardinella jussieu* (Lacepède, 1803)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Ilahude et al. 1978
Clupeiformes	**Clupeidae**	***Sardinella lemuru* Bleeker, 1853**	**Digenea**	**nr**	**Digenea indet.**	**stomach**	**Present study**
Clupeiformes	**Clupeidae**	***Sardinella lemuru* Bleeker, 1853**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**pyloric caeca**	**Present study**
Clupeiformes	Clupeidae	*Sardinella longiceps* Valenciennes, 1847	Nematoda	Anisakidae	*Anisakis* sp.[30]	nr	Martosewojo 1980
Clupeiformes	Clupeidae	*Sardinella longiceps* Valenciennes, 1847	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Martosewojo 1980
Clupeiformes	Clupeidae	*Spratelloides delicatulus* (Bennett, 1832)	Crustacea: Copepoda	Pennellidae	*Peniculus communis* Leigh-Sharpe, 1934	nr (fins)	Leigh-Sharpe 1934
Clupeiformes	Engraulidae	*Coilia dussumieri* Valenciennes, 1848	Crustacea: Iopoda	Cymothoidae	*Nerocila depressa* Milne Edwards, 1840	surface	Bruce & Harrison-Nelson 1988
Clupeiformes	Engraulidae	*Coilia dussumieri* Valenciennes, 1848	Crustacea: Iopoda	Cymothoidae	*Nerocila depressa* Milne Edwards, 1840	surface	Sidabalok 2013
Clupeiformes	Engraulidae	*Encrasicholina heteroloba* (Rüppell, 1837)	Crustacea: Copepoda	Pennellidae	*Cardiodectes hardenbergi* Markewitsch, 1936	surface	Markewitsch 1936
Clupeiformes	Engraulidae	*Stolephorus indicus* (van Hasselt, 1823)	Crustacea: Iopoda	Cymothoidae	*Anilocra alloceraea* Koelbel, 1879	nr	Bruce 1987c
Clupeiformes	Engraulidae	*Stolephorus indicus* (van Hasselt, 1823)	Crustacea: Iopoda	Cymothoidae	*Nerocila phaiopleura* Bleeker, 1857	caudal peduncle	Bruce 1987b
Clupeiformes	Engraulidae	*Stolephorus* sp.	Crustacea: Iopoda	Cymothoidae	*Anilocra alloceraea* Koelbel, 1879	surface	Bruce & Harrison-Nelson 1988
Clupeiformes	Engraulidae	*Stolephorus* sp.	Crustacea: Iopoda	Cymothoidae	*Anilocra alloceraea* Koelbel, 1879	surface	Sidabalok 2013
Clupeiformes	Engraulidae	*Stolephorus* sp.	Crustacea: Iopoda	Cymothoidae	*Nerocila* sp.	nr	Sidabalok 2013
Clupeiformes	**Pristigateridae**	***Opisthopterus tardoore* (Cuvier, 1829)**	**Cestoda**	**Tentaculariidae**	***Heteronybelinia* sp.**	**body cavity**	**Present study**
Clupeiformes	**Pristigateridae**	***Opisthopterus tardoore* (Cuvier, 1829)**	**Digenea**	**Hemiuridae**	**Hemiuridae indet.**	**stomach**	**Present study**
Clupeiformes	**Pristigateridae**	***Opisthopterus tardoore* (Cuvier, 1829)**	**Digenea**	**nr**	**Digenea indet.**	**stomach**	**Present study**
Clupeiformes	**Pristigateridae**	***Opisthopterus tardoore* (Cuvier, 1829)**	**Microsporea**	**nr**	**Microsporea indet.**	**stomach wall**	**Present study**
Clupeiformes	**Pristigateridae**	***Opisthopterus tardoore* (Cuvier, 1829)**	**Monogenea**	**Mazocraeidae**	**Mazocraeidea indet. spp. (two species/morphotypes)**	**gills**	**Present study**
Clupeiformes	Pristigateridae	*Opisthopterus tardoore* (Cuvier, 1829)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017, workshop
Clupeiformes	**Pristigateridae**	***Opisthopterus tardoore* (Cuvier, 1829)**	**Nematoda**	**nr**	**Nematoda indet.**	**mesenteries**	**Present study**
Elopiformes	Megalopidae	*Megalops cyprinoides* (Broussonet, 1782)	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	stomach wall	Palm 2004
Elopiformes	Megalopidae	*Megalops cyprinoides* (Broussonet, 1782)	Monogenea	Diplectanidae	*Diplectanocotyla gracilis* Yamaguti, 1953	gills	Yamaguti 1953a
Elopiformes	Megalopidae	*Megalops cyprinoides* (Broussonet, 1782)	Nematoda	Ascarididae	Ascarididae indet. (as *Porrocaecum* sp.)	body cavity	Yamaguti 1954c
Gadiformes	Macrouridae	*Coelorinchus* sp.	Cestoda	Lacistorhynchidae	*Grillotia (Christianella) yuniariae* Palm, 2004	liver	Palm 2004
Gadiformes	Macrouridae	*Hymenocephalus str. striatissimus* Jordan & Gilbert, 1904	Crustacea: Copepoda	Pennellidae	*Sarcotretes eristaliformis* (Brian, 1908)	nr	Leigh-Sharpe 1934
Gadiformes	Macrouridae	*Hymenocephalus str. striatissimus* Jordan & Gilbert, 1904	Crustacea: Copepoda	Sphyriidae	*Lophoura cardusa* (Leigh-Sharpe, 1934)	nr	Leigh-Sharpe 1934
Gadiformes	Macrouridae	*Malacocephalus laevis* (Lowe, 1843)	Crustacea: Copepoda	Lernaeopodidae	*Parabrachiella superba* (Leigh-Sharpe, 1934)	pharynx	Leigh-Sharpe 1934
Gadiformes	Moridae	*Physiculus* sp.	Cestoda	Lacistorhynchidae	*Grillotia (Christianella) yuniariae* Palm, 2004	liver	Palm 2004
Gonorynchiformes	Chanidae	*Chanos chanos* (Forsskål, 1775)	Crustacea: Iopoda	Aegidae	*Alitropus typus* H. Milne Edwards, 1840 freshwater species	surface	Bruce 2009
Gonorynchiformes	Chanidae	*Chanos chanos* (Forsskål, 1775)	Crustacea: Iopoda	Aegidae	*Alitropus typus* H. Milne Edwards, 1840 freshwater species	surface	Kabata 1985
Gonorynchiformes	Chanidae	*Chanos chanos* (Forsskål, 1775)	Crustacea: Iopoda	Aegidae	*Alitropus typus* H. Milne Edwards, 1840 freshwater species	surface	Sidabalok 2013

Lophiiformes	Lophiidae	*Lophiomus setigerus* (Vahl, 1797)	Cestoda	Eutetrarhynchidae	*Oncomegas javensis* Palm, 2004	intestine	Palm 2004
Lophiiformes	Ogcocephalidae	*Halieutaea stellata* (Vahl, 1797)	Cestoda	Tentaculariidae	*Kotorella pronosoma* (Stossich, 1901) Euzet & Radujkovic, 1989	stomach wall	Palm 2004
Myctophiformes	Myctophidae	*Diaphus suborbitalis* Weber, 1913	Crustacea: Copepoda	(Siphonostomatoida)	Siphonostomatoida indet.	nr	Leigh-Sharpe 1934
Myctophiformes	Myctophidae	*Symbolophorus evermanni* (Gilbert, 1905)	Crustacea: Copepoda	Pennellidae	*Sarcotretes scopeli* Jungersen, 1911	nr	Leigh-Sharpe 1934
Ophidiformes	Ophidiidae	*Brotula multibarbata* Temminck & Schlegel, 1846	Cestoda	Eutetrarhynchidae	*Oncomegas javensis* Palm, 2004	intestine	Palm 2004
Ophidiformes	Ophidiidae	*Neobythites malayanus* Weber, 1913	Crustacea: Copepoda	Chondracanthidae	*Humphreysia floreata* Leigh-Sharpe, 1934	isthmus	Leigh-Sharpe 1934
Ophidiformes	Ophidiidae	Ophidiidae indet.	Cestoda	Lacistorhynchidae	*Grillotia (Christianella) yuniariae* Palm, 2004	liver	Palm 2004
Perciformes	Acanthuridae	*Acanthurus* sp.	Crustacea: Copepoda	Hatschekiidae	*Hatschekia teuthidis* Yamaguti, 1954	gills	Yamaguti 1954c
Perciformes	Acanthuridae	*Acanthurus* sp.	Digenea	Gyliauchenidae	*Gyliauchen nahaensis* Ozaki, 1937	pyloric caeca	Yamaguti 1953b
Perciformes	Acanthuridae	*Acanthurus* sp.	Digenea	Gyliauchenidae	*Gyliauchen papillatus* (Goto & Matsudaira, 1918)	intestine	Yamaguti 1953b
Perciformes	Acanthuridae	*Acanthurus xanthopterus* Valenciennes, 1835	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Muthmainnah 2004
Perciformes	**Acanthuridae**	***Naso brachycentron* (Valenciennes, 1835)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**mouth**	**Present study**
Perciformes	**Acanthuridae**	***Naso brachycentron* (Valenciennes, 1835)**	**Digenea**	**Gyliauchenidae**	***Gyliauchen* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	**Acanthuridae**	***Naso brachycentron* (Valenciennes, 1835)**	**Digenea**	**Lecithasteridae**	***Bilacinia* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	Acanthuridae	*Naso* sp.	Crustacea: Iopoda	Cymothoidae	*Anilocra amboinensis* Schiødte & Meinert, 1881	nr	Bruce & Harrison-Nelson 1988
Perciformes	Acanthuridae	*Naso* sp.	Crustacea: Iopoda	Cymothoidae	*Anilocra amboinensis* Schiødte & Meinert, 1881	nr	Monod 1976
Perciformes	Acanthuridae	*Naso thynnoides* (Cuvier, 1829)	Crustacea: Iopoda	Cymothoidae	*Anilocra amboinensis* Schiødte & Meinert, 1881	mouth	Monod & Serène 1976
Perciformes	Acanthuridae	*Naso thynnoides* (Cuvier, 1829)	Crustacea: Iopoda	Cymothoidae	*Anilocra amboinensis* Schiødte & Meinert, 1881	mouth	Monod 1976
Perciformes	**Ambassidae**	***Ambassis* sp.**	**Digenea**	**Heterophyidae**	**Heterophyidae indet.**	**mesenteries**	**Present study, workshop Bali**
Perciformes	Anabantidae	*Anabas testudineus* (Bloch, 1792) freshwater	Cestoda	nr	Trypanorhyncha indet.	body cavity	Sachlan 1952
Perciformes	Apogonidae	*Apogon kallopterus* Bleeker, 1856	Crustacea: Iopoda	Cymothoidae	*Anilocra apogonae* Bruce, 1987	surface	Bruce 1987c
Perciformes	Apogonidae	*Apogon kallopterus* Bleeker, 1856	Crustacea: Iopoda	Cymothoidae	*Anilocra apogonae* Bruce, 1987	surface	Monod 1976
Perciformes	Apogonidae	*Apogon kallopterus* Bleeker, 1856	Crustacea: Iopoda	Cymothoidae	*Anilocra* sp.	surface	Monod & Serène 1976
Perciformes	Apogonidae	*Apogon kallopterus* Bleeker, 1856	Crustacea: Iopoda	Cymothoidae	*Anilocra* sp.	surface	Monod 1976
Perciformes	Apogonidae	*Apogon novemfasciatus* Cuvier, 1828	Crustacea: Copepoda	(Siphonostomatoida)	*Thanatodectes semaphorus* Leigh-Sharpe, 1934	nr	Leigh-Sharpe 1934
Perciformes	Apogonidae	*Apogon* sp.	Crustacea: Copepoda	Pennellidae	*Cardiodectes rubosus* Leigh-Sharpe, 1934	nr	Leigh-Sharpe 1934
Perciformes	Apogonidae	*Apogon* sp.	Crustacea: Iopoda	Cymothoidae	*Renocila ovata* Miers, 1880	surface	Nierstrasz 1931
Perciformes	Apogonidae	*Ostorhinchus cookii* (MacLeay, 1881)	Crustacea: Iopoda	Cymothoidae	*Renocila ovata* Miers, 1880	behind head	Palm et al. 2018
Perciformes	Ariommatidae	*Ariomma indicum* (Day, 1871)	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus* sp.	gills	Theisen 2009
Perciformes	**Ariommatidae**	***Ariomma indicum* (Day, 1871)**	**Crustacea: Copepoda**	**Bomolochidae**	***Nothobomolochus* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	Ariommatidae	*Ariomma indicum* (Day, 1871)	Crustacea: Copepoda	Caligidae	*Caligus kanagurta* Pillai, 1961	gills	Theisen 2009
Perciformes	**Ariommatidae**	***Ariomma indicum* (Day, 1871)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet.**	**body cavity**	**Present study, workshop Bali**
Perciformes	Ariommatidae	*Ariomma indicum* (Day, 1871)	Digenea	Fellodistomidae	*Monascus* sp.	intestine	Theisen 2009
Perciformes	Ariommatidae	*Ariomma indicum* (Day, 1871)	Monogenea	Diclidophoridae	*Choricotyle* sp.	gills	Theisen 2009
Perciformes	Ariommatidae	*Ariomma indicum* (Day, 1871)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Theisen 2009
Perciformes	Blenniidae	*Cirripectes castaneus* (Valenciennes, 1836)	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus glomerosus* Dojiri & Cressey, 1987	nr	Dojiri & Cressey 1987
Perciformes	Blenniidae	*Cirripectes castaneus* (Valenciennes, 1836)	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus williamsi* Dojiri & Cressey, 1987	gill cavity	Dojiri & Cressey 1987
Perciformes	**Bramidae**	***Brama* cf. *orcini* Cuvier, 1831**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Bramidae**	***Brama* cf. *orcini* Cuvier, 1831**	**Cestoda**	**Bothriocephalidae**	**Bothriocephalidae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Bramidae**	***Brama* cf. *orcini* Cuvier, 1831**	**Cestoda**	**Sphyriocephalidae**	***Heterosphyriocephalus oheulumiae* Palm, 2004**	**stomach**	**Present study, workshop Bali**

Perciformes	**Bramidae**	***Brama* cf. *orcini* Cuvier, 1831**	**Cestoda**	**Tentacularidae**	***Nybelinia*sp.**	**body cavity**	**Present study, workshop Bali**
Perciformes	**Bramidae**	***Brama* cf. *orcini* Cuvier, 1831**	**Crustacea: Copepoda**	**Hatschekiidae**	***Hatschekia* sp. (*confera*?)**	**gills**	**Present study, workshop Bali**
Perciformes	Bramidae	*Brama* cf. *orcini* Cuvier, 1831	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis*	body cavity	Palm & Theisen et al. 2017
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Acanthocephala	Rhadinorhynchidae	*Gorgorhynchus* cf. *robertdollfusi* Golvan, 1956	body cavity	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Acanthocephala	Rhadinorhynchidae	*Gorgorhynchus* cf. *robertdollfusi* Golvan, 1956	body cavity	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Acanthocephala	Rhadinorhynchidae	*Rhadinorhynchus* sp.	intestine	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Acanthocephala	Rhadinorhynchidae	*Rhadinorhynchus* sp.	intestine	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	nr	Cestoda indet.	nr	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	nr	Cestoda indet.	nr	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	Sphyriocephalidae	*Heterosphyriocephalus tergestinus* (Pintner, 1913) Dallarés et al. 2016	stomach wall	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	Sphyriocephalidae	*Heterosphyriocephalus tergestinus* (Pintner, 1913) Dallarés et al. 2016	stomach wall	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	Sphyriocephalidae	*Heterosphyriocephalus tergestinus* (Pintner, 1913) Dallarés et al. 2016	stomach	Palm 2004
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	Tentacularidae	*Heteronybelinia estigmena* (Dollfus, 1960) Palm, 1999	stomach wall	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	Tentacularidae	*Heteronybelinia estigmena* (Dollfus, 1960) Palm, 1999	stomach wall	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	Tentacularidae	*Heteronybelinia estigmena* (Dollfus, 1960) Palm, 1999	stomach	Palm 2004
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	Tentacularidae	*Mixonybelinia lepturi* Palm, 2004	nr	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	Tentacularidae	*Mixonybelinia lepturi* Palm, 2004	nr	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	Tentacularidae	*Nybelinia africana* Dollfus, 1960	stomach wall	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	Tentacularidae	*Nybelinia africana* Dollfus, 1960	stomach wall	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	Tentacularidae	*Nybelinia africana* Dollfus, 1960	body cavity	Palm 2004
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	Tentacularidae	*Tentacularia coryphaenae* Bosc, 1802	musculature	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Cestoda	Tentacularidae	*Tentacularia coryphaenae* Bosc, 1802	musculature	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Crustacea: Copepoda	Caligidae	*Caligus elongatus* (von Nordmann, 1832)	gills	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Crustacea: Copepoda	Caligidae	*Caligus elongatus* (von Nordmann, 1832)	gills	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Crustacea: Copepoda	Hatschekiidae	*Hatschekia conifera* (Yamaguti, 1939)	gills	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Crustacea: Copepoda	Hatschekiidae	*Hatschekia conifera* (Yamaguti, 1939)	gills	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Digenea	Hemiuridae	Hemiuridae indet.	nr	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Digenea	Hemiuridae	Hemiuridae indet.	nr	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Digenea	nr	Digenea indet.	nr	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Digenea	nr	Digenea indet.	nr	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Nematoda	Acanthocheilidae	*Pseudanisakis* sp.	body cavity	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Nematoda	Acanthocheilidae	*Pseudanisakis* sp.	body cavity	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Jakob & Palm 2006
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Jakob 2005
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm & Theisen et al. 2017
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm et al. 2008
Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Nematoda	Raphidascarididae	*Raphidascaris* sp.	stomach wall	Jakob & Palm 2006

Perciformes	Bramidae	*Brama dussumieri* Cuvier, 1831	Nematoda	Raphidascarididae	*Raphidascaris* sp.	stomach wall	Jakob 2005
Perciformes	Bramidae	Bramidae indet.	Cestoda	Sphyriocephalidae	*Hepatoxylon trichiuri* (Holten, 1802) Bosc, 1811	body cavity	Palm 2004
Perciformes	Bramidae	Bramidae indet.	Cestoda	Sphyriocephalidae	*Heterosphyriocephalus oheulumiae* Palm, 2004	operculum	Palm 2004
Perciformes	Bramidae	Bramidae indet.	Cestoda	Tentaculariidae	*Heteronybelinia estigmena* (Dollfus, 1960) Palm, 1999	musculature	Palm 2004
Perciformes	Bramidae	Bramidae indet.	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	intestine	Palm 2004
Perciformes	Bramidae	*Taractes rubescens* (Jordan & Evermann, 1887)	Cestoda	Gymnorhynchidae	*Molicola uncinatus* (Linton, 1924)	musculature	Palm 2004
Perciformes	Bramidae	*Taractes rubescens* (Jordan & Evermann, 1887)	Cestoda	Gymnorhynchidae	*Molicola walteri* Palm, 2004	musculature	Palm 2004
Perciformes	Bramidae	*Taractes rubescens* (Jordan & Evermann, 1887)	Cestoda	Sphyriocephalidae	*Hepatoxylon trichiuri* (Holten, 1802) Bosc, 1811	body cavity	Palm 2004
Perciformes	Bramidae	*Taractichthys steindachneri* (Döderlein, 1883)	Cestoda	Eutetrarhynchidae	*Oncomegas javensis* Palm, 2004	stomach wall	Palm 2004
Perciformes	Bramidae	*Taractichthys steindachneri* (Döderlein, 1883)	Cestoda	Gymnorhynchidae	*Molicola uncinatus* (Linton, 1924)	body cavity	Palm 2004
Perciformes	Bramidae	*Taractichthys steindachneri* (Döderlein, 1883)	Cestoda	Gymnorhynchidae	*Molicola walteri* Palm, 2004	musculature	Palm 2004
Perciformes	Bramidae	*Taractichthys steindachneri* (Döderlein, 1883)	Cestoda	Sphyriocephalidae	*Hepatoxylon trichiuri* (Holten, 1802) Bosc, 1811	body cavity	Palm 2004
Perciformes	Bramidae	*Taractichthys steindachneri* (Döderlein, 1883)	Cestoda	Sphyriocephalidae	*Heterosphyriocephalus oheulumiae* Palm, 2004	operculum	Palm 2004
Perciformes	Bramidae	*Taractichthys steindachneri* (Döderlein, 1883)	Cestoda	Sphyriocephalidae	*Heterosphyriocephalus tergestinus (*Pintner, 1913) Dallarés et al. 2016	stomach	Palm 2004
Perciformes	Bramidae	*Taractichthys steindachneri* (Döderlein, 1883)	Cestoda	Sphyriocephalidae	*Sphyriocephalus dollfusi* (Bussieras & Aldrin, 1968)	stomach	Palm 2004
Perciformes	Bramidae	*Taractichthys steindachneri* (Döderlein, 1883)	Cestoda	Tentaculariidae	*Heteronybelinia estigmena* (Dollfus, 1960) Palm, 1999	body cavity	Palm 2004
Perciformes	Bramidae	*Taractichthys steindachneri* (Döderlein, 1883)	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	stomach wall	Palm 2004
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Crustacea: Copepoda	Caligidae	*Caligus grandiabdominalis* Yamaguti, 1954	gills	Yamaguti 1954d
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus caesionis* Yamaguti, 1954	gills	Yamaguti 1954d
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Crustacea: Copepoda	Lernanthropidae	*Sagum folium* Ho, Liu & Lin, 2011	gills	Hambarsika 2012
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Crustacea: Copepoda	Lernanthropidae	*Sagum folium* Ho, Liu & Lin, 2011	gills	Hambarsika et al. 2014
Perciformes	**Caesionidae**	***Caesio cuning* (Bloch, 1791)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Sagum folium* Ho, Liu & Lin, 2011**	**gills**	**Present study**
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	operculum	Hambarsika 2012
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	operculum	Hambarsika et al. 2014
Perciformes	**Caesionidae**	***Caesio cuning* (Bloch, 1791)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**operculum**	**Present study**
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Digenea	Hemiuridae	*Aphanurus caesionis* Yamaguti, 1952	stomach	Yamaguti 1952
Perciformes	**Caesionidae**	***Caesio cuning* (Bloch, 1791)**	**Digenea**	**Hemiuridae**	**Hemiuridae indet.**	**stomach**	**Present study**
Perciformes	**Caesionidae**	***Caesio cuning* (Bloch, 1791)**	**Digenea**	**nr**	**Digenea indet.**	**stomach**	**Present study**
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Monogenea	Ancyrocephalidae	*Haliotrematoides caesionis* (Yamaguti, 1953) Kritsky et al., 2009	gills	Yamaguti 1953a
Perciformes	**Caesionidae**	***Caesio cuning* (Bloch, 1791)**	**Monogenea**	**Ancyrocephalidae**	***Haliotrematoides caesionis* (Yamaguti, 1953) Kritsky et al., 2009**	**gills**	**Present study**
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Kuhn et al. 2013
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Kuhn et al. 2011
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm et al. 2008
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Nematoda	Cucullanidae	*Cucullanus* sp.	intestine	Pradipta 2012
Perciformes	**Caesionidae**	***Caesio cuning* (Bloch, 1791)**	**Nematoda**	**Cucullanidae**	***Cucullanus* sp.**	**intestine**	**Present study**
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Nematoda	Raphidascarididae	cf. *Hysterothylacium* sp. (as Nematoda indet.)	nr	Hariyadi 2006
Perciformes	Caesionidae	*Caesio cuning* (Bloch, 1791)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	intestine	Pradipta 2012
Perciformes	**Caesionidae**	***Caesio cuning* (Bloch, 1791)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**intestine**	**Present study**
Perciformes	Caesionidae	*Caesio* sp.	Nematoda	Anisakidae	*Anisakis* sp.[30]	gonads	Setyobudi et al. 2011

Perciformes	**Caesionidae**	***Caesio xanthonota* Bleeker, 1853**	**Digenea**	**Hemiuridae**	***Lecithochirium* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	**Caesionidae**	***Caesio xanthonota* Bleeker, 1853**	**Digenea**	**nr**	**Digenea indet.**	**guts**	**Present study, workshop Bali**
Perciformes	Caesionidae	*Pterocaesio digramma* (Bleeker, 1864)	Acanthocephala	nr	Acanthocephala indet.	intestine	Pradipta 2012
Perciformes	**Caesionidae**	***Pterocaesio digramma* (Bleeker, 1864)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**intestine**	**Present study**
Perciformes	Caesionidae	*Pterocaesio digramma* (Bleeker, 1864)	Acanthocephala	Rhadinorhynchidae	*Rhadinorhynchus* sp.	intestine	Pradipta 2012
Perciformes	**Caesionidae**	***Pterocaesio digramma* (Bleeker, 1864)**	**Acanthocephala**	**Rhadinorhynchidae**	***Rhadinorhynchus* sp.**	**intestine**	**Present study**
Perciformes	Caesionidae	*Pterocaesio digramma* (Bleeker, 1864)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	guts	Pradipta 2012
Perciformes	**Caesionidae**	***Pterocaesio digramma* (Bleeker, 1864)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**guts**	**Present study, workshop Bali**
Perciformes	Caesionidae	*Pterocaesio digramma* (Bleeker, 1864)	Crustacea: Copepoda	Lernanthropidae	*Sagum folium* Ho, Liu & Lin, 2011	gills	Hambarsika 2012
Perciformes	Caesionidae	*Pterocaesio digramma* (Bleeker, 1864)	Crustacea: Copepoda	Lernanthropidae	*Sagum folium* Ho, Liu & Lin, 2011	gills	Hambarsika et al. 2014
Perciformes	**Caesionidae**	***Pterocaesio digramma* (Bleeker, 1864)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Sagum folium* Ho, Liu & Lin, 2011**	**gills**	**Present study**
Perciformes	Caesionidae	*Pterocaesio digramma* (Bleeker, 1864)	Crustacea: Copepoda	Pennellidae	*Peniculus communis* Leigh-Sharpe, 1934	nr (fins)	Leigh-Sharpe 1934
Perciformes	Caesionidae	*Pterocaesio digramma* (Bleeker, 1864)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Hambarsika 2012
Perciformes	Caesionidae	*Pterocaesio digramma* (Bleeker, 1864)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Hambarsika et al. 2014
Perciformes	**Caesionidae**	***Pterocaesio digramma* (Bleeker, 1864)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study**
Perciformes	**Caesionidae**	***Pterocaesio digramma* (Bleeker, 1864)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet.**	**pyloric caeca**	**Present study**
Perciformes	**Caesionidae**	***Pterocaesio digramma* (Bleeker, 1864)**	**Digenea**	**Hemiuridae**	**Hemiuridae indet. spp. (two species/morphotypes)**	**stomach**	**Present study**
Perciformes	**Caesionidae**	***Pterocaesio digramma* (Bleeker, 1864)**	**Digenea**	**Hemiuridae**	***Lecithochirium* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	Caesionidae	*Pterocaesio digramma* (Bleeker, 1864)	Nematoda	Anisakidae	*Terranova* sp.	intestine	Pradipta 2012
Perciformes	**Caesionidae**	***Pterocaesio digramma* (Bleeker, 1864)**	**Nematoda**	**Anisakidae**	***Terranova* sp.**	**intestine**	**Present study**
Perciformes	**Caesionidae**	***Pterocaesio digramma* (Bleeker, 1864)**	**Nematoda**	**nr**	**Nematoda indet.**	**stomach**	**Present study**
Perciformes	Caesionidae	*Pterocaesio digramma* (Bleeker, 1864)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	intestine	Pradipta 2012
Perciformes	**Caesionidae**	***Pterocaesio digramma* (Bleeker, 1864)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**intestine**	**Present study**
Perciformes	Caesionidae	*Pterocaesio digramma* (Bleeker, 1864)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	intestine	Pradipta 2012
Perciformes	**Caesionidae**	***Pterocaesio digramma* (Bleeker, 1864)**	**Nematoda**	**Raphidascarididae**	***Raphidascaris* sp.**	**intestine**	**Present study**
Perciformes	**Carangidae**	***Alectis indica* (Rüppell, 1830)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Alectis indica* (Rüppell, 1830)**	**Crustacea: Isopoda**	**Cymothoidae**	***Cymothoa elegans* Bovallius, 1885**	**mouth**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Alectis indica* (Rüppell, 1830)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Alectis indica* (Rüppell, 1830)**	**Monogenea**	**(Polyopisthocotylea)**	**Polyopisthocotylea indet.**	**gills**	**Present study, workshop Bali**
Perciformes	Carangidae	*Alectis* sp.	Crustacea: Copepoda	Caligidae	*Caligus robustus* Bassett-Smith, 1898	nr	Cressey 1991
Perciformes	**Carangidae**	***Alepes djedaba* (Forsskål, 1775)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Alepes djedaba* (Forsskål, 1775)**	**Cestoda**	**nr**	**Cestoda indet.**	**stomach**	**Present study, workshop Bali**
Perciformes	Carangidae	*Alepes djedaba* (Forsskål, 1775)	Crustacea: Copepoda	Caligidae	*Caligus bicycletus* Heegaard, 1945	mouth	Heegaard 1945
Perciformes	Carangidae	*Alepes djedaba* (Forsskål, 1775)	Crustacea: Copepoda	Caligidae	cf. *Caligus alepicolus* (Heegaard, 1945) Boxshall, 2018	mouth	Heegaard 1945
Perciformes	**Carangidae**	***Alepes djedaba* (Forsskål, 1775)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Alepes djedaba* (Forsskål, 1775)**	**Digenea**	**Fellodistomidae**	***Monascus* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Alepes djedaba* (Forsskål, 1775)**	**Digenea**	**Hemiuridae**	***Lecithocladium* sp.**	**stomach**	**Present study, workshop Bali**
Perciformes	Carangidae	*Alepes melanoptera* (Swainson, 1839)	Crustacea: Copepoda	Pennellidae	Pennellidae indet.	gills	Falacy 2013
Perciformes	**Carangidae**	***Alepes melanoptera* (Swainson, 1839)**	**Crustacea: Copepoda**	**Pennellidae**	**Pennellidae indet.**	**gills**	**Present study**
Perciformes	Carangidae	*Alepes melanoptera* (Swainson, 1839)	Digenea	Echinostomatidae	*Echinostoma* sp.	stomach	Falacy 2013

Perciformes	**Carangidae**	***Alepes melanoptera* (Swainson, 1839)**	**Digenea**	**Echinostomatidae**	***Echinostoma* sp.**	**stomach**	**Present study**
Perciformes	Carangidae	*Alepes melanoptera* (Swainson, 1839)	Digenea	nr	Digenea indet.	guts	Falacy 2013
Perciformes	**Carangidae**	***Alepes melanoptera* (Swainson, 1839)**	**Digenea**	**nr**	**Digenea indet.**	**guts**	**Present study**
Perciformes	**Carangidae**	***Atropus atropos* (Bloch & Schneider, 1801)**	**Crustacea: Copepoda**	**Bomolochidae**	***Bomolochus* sp.**	**gills**	**Present study**
Perciformes	**Carangidae**	***Atropus atropos* (Bloch & Schneider, 1801)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**gills**	**Present study**
Perciformes	**Carangidae**	***Atropus atropos* (Bloch & Schneider, 1801)**	**Crustacea: Copepoda**	**Caligidae**	***Parapetalus* sp.**	**mouth**	**Present study**
Perciformes	**Carangidae**	***Atropus atropos* (Bloch & Schneider, 1801)**	**Crustacea: Copepoda**	**Ergasilidae**	***Ergasilus* sp.**	**gills**	**Present study**
Perciformes	**Carangidae**	***Atropus atropos* (Bloch & Schneider, 1801)**	**Crustacea: Copepoda**	**Taeniacanthidae**	***Taeniacanthus* spp. (two species/morphotypes)**	**gills**	**Present study**
Perciformes	**Carangidae**	***Atropus atropos* (Bloch & Schneider, 1801)**	**Digenea**	**Hemiuridae**	**Hemiuridae indet. spp. (two species/morphotypes)**	**guts**	**Present study**
Perciformes	**Carangidae**	***Atropus atropos* (Bloch & Schneider, 1801)**	**Nematoda**	**Camallanidae**	***Camallanus* cf. *atropusi* Bashirullah & Khan, 1973**	**intestine**	**Present study**
Perciformes	**Carangidae**	***Atropus atropos* (Bloch & Schneider, 1801)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**mesenteries**	**Present study**
Perciformes	Carangidae	*Atule mate* (Cuvier, 1833)	Acanthocephala	Rhadinorhynchidae	*Rhadinorhynchus lintoni* Cable & Linderoth, 1963	mesenteries	Hennersdorf et al. 2016
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Cestoda**	**(Pseudophyllidea)**	**Pseudophyllidea indet. (larva)**	**stomach**	**Present study**
Perciformes	Carangidae	*Atule mate* (Cuvier, 1833)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Hennersdorf et al. 2016
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Cestoda**	**Pseudotobothriidae**	***Parotobothrium balli* (Southwell, 1929) Palm, 2004**	**stomach wall**	**Present study**
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Cestoda**	**Tentaculariidae**	***Heteronybelinia*sp.**	**body cavity**	**Present study**
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Cestoda**	**Tentaculariidae**	***Nybelinia indica* Chandra, 1986**	**body cavity**	**Present study**
Perciformes	Carangidae	*Atule mate* (Cuvier, 1833)	Cestoda	Tentaculariidae	*Nybelinia* sp. (cf. *indica* Chandra, 1986)	gills	Palm 2004
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Crustacea: Copepoda**	**Bomolochidae**	**Bomolochidae indet.**	**gills**	**Present study**
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* spp.**	**mouth**	**Present study**
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus* sp.**	**gills**	**Present study**
Perciformes	Carangidae	*Atule mate* (Cuvier, 1833)	Digenea	Bucephalidae	*Bucephalus* cf. *margaritae* Ozaki & Ishibashi, 1934	guts	Hennersdorf et al. 2016
Perciformes	Carangidae	*Atule mate* (Cuvier, 1833)	Digenea	Didymozoidae	Didymozoidae indet.	stomach	Hennersdorf et al. 2016
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Digenea**	**Fellodistomidae**	***Tergestia* sp.**	**intestine**	**Present study**
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Digenea**	**Gorgoderidae**	***Phyllodistomum* sp.**	**stomach**	**Present study**
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Digenea**	**Hemiuridae**	***Ectenurus* cf. *selari* (Parukhin, 1966)**	**stomach**	**Present study**
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Digenea**	**Hemiuridae**	***Lecithocladium* cf. *angustiovum* Yamaguti, 1953**	**stomach**	**Present study**
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Digenea**	**Lecithasteridae**	***Aponurus* sp.**	**stomach**	**Present study**
Perciformes	Carangidae	*Atule mate* (Cuvier, 1833)	Digenea	Monorchiidae	*Opisthomonorcheides decapteri* Parukhin, 1966	guts	Bray et al. 2017, in part workshop
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Digenea**	**Opecoelidae**	**Opecoelidae indet.**	**intestine**	**Present study**
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Hirudinea**	**nr**	**Hirudinea indet.**	**gills**	**Present study**
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Monogenea**	**(Monopisthocotylea)**	**Monopisthocotylea indet.**	**gills**	**Present study**
Perciformes	Carangidae	*Atule mate* (Cuvier, 1833)	Monogenea	Mazocraeidae	Mazocraeidea indet.	gills	Hennersdorf et al. 2016
Perciformes	Carangidae	*Atule mate* (Cuvier, 1833)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Ilahude 1980
Perciformes	Carangidae	*Atule mate* (Cuvier, 1833)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Ilahude et al. 1978
Perciformes	Carangidae	*Atule mate* (Cuvier, 1833)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm & Theisen et al. 2017
Perciformes	Carangidae	*Atule mate* (Cuvier, 1833)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm et al. 2008
Perciformes	Carangidae	*Atule mate* (Cuvier, 1833)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Martosewojo 1980
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Nematoda**	**Anisakidae**	***Terranova* sp.**	**body cavity**	**Present study**
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Nematoda**	**Camallanidae**	***Camallanus* cf. *carangis* Olsen, 1954**	**intestine**	**Present study**

Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Nematoda**	**Camallanidae**	***Camallanus* sp.**	**intestine**	**Present study**
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Nematoda**	**nr**	**Nematoda indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Atule mate* (Cuvier, 1833)**	**Nematoda**	**Philometridae**	***Philometra* sp.**	**operculum**	**Present study**
Perciformes	Carangidae	*Atule mate* (Cuvier, 1833)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	mesenteries	Hennersdorf et al. 2016
Perciformes	Carangidae	*Carangoides coeruleopinnatus* (Rüppell, 1830)	Cestoda	Otobothriidae	*Otobothrium* cf. *carcharidis* (Shipley & Hornell, 1906) Pintner, 1913	mesenteries	Palm 2004
Perciformes	Carangidae	*Carangoides malabaricus* (Bloch & Schneider, 1801)	Crustacea: Copepoda	Caligidae	*Caligus* sp.	gills	Pardede 2000
Perciformes	Carangidae	*Carangoides malabaricus* (Bloch & Schneider, 1801)	Crustacea: Copepoda	Caligidae	*Parapetalus* sp.	gills	Pardede 2000
Perciformes	Carangidae	*Carangoides malabaricus* (Bloch & Schneider, 1801)	Crustacea: Isopoda	Cymothoidae	*Anilocra* sp.	gills	Pardede 2000
Perciformes	Carangidae	*Carangoides malabaricus* (Bloch & Schneider, 1801)	Digenea	Azygiidae	*Azygia* sp.	intestine	Pardede 2000
Perciformes	Carangidae	*Carangoides malabaricus* (Bloch & Schneider, 1801)	Digenea	Bucephalidae	*Alcicornis* sp.	intestine	Pardede 2000
Perciformes	Carangidae	*Carangoides malabaricus* (Bloch & Schneider, 1801)	Digenea	Derogenidae	*Derogenes* sp.	intestine	Pardede 2000
Perciformes	Carangidae	*Carangoides malabaricus* (Bloch & Schneider, 1801)	Nematoda	Anisakidae	*Anisakis* sp.[30]	intestine	Pardede 2000
Perciformes	Carangidae	*Carangoides malabaricus* (Bloch & Schneider, 1801)	Nematoda	Camallanidae	*Camallanus* sp.	intestine	Pardede 2000
Perciformes	**Carangidae**	***Caranx* cf. *heberi* (juvenile fish)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**surface**	**Present study**
Perciformes	**Carangidae**	***Caranx* cf. *heberi* (juvenile fish)**	**Digenea**	**Acanthocolpidae**	**Acanthocolpidae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Caranx* cf. *heberi* (juvenile fish)**	**Digenea**	**Bucephalidae**	***Bucephalus* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Caranx heberi* (Bennett, 1830)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**intestine**	**Present study**
Perciformes	**Carangidae**	***Caranx heberi* (Bennett, 1830)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus brevicaudus* Pillai, 1963**	**gills**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Caranx heberi* (Bennett, 1830)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**gills**	**Present study**
Perciformes	**Carangidae**	***Caranx heberi* (Bennett, 1830)**	**Crustacea: Copepoda**	**Pennellidae**	***Peniculus* cf. *communis* Leigh-Sharpe, 1934**	**fins**	**Present study**
Perciformes	**Carangidae**	***Caranx heberi* (Bennett, 1830)**	**Digenea**	**Acanthocolpidae**	***Stephanostomum* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Caranx heberi* (Bennett, 1830)**	**Digenea**	**Bucephalidae**	**Bucephalidae indet.**	**guts**	**Present study**
Perciformes	Carangidae	*Caranx heberi* (Bennett, 1830)	Digenea	Bucephalidae	*Bucephalus damriyasai* Bray, Palm & Theisen, 2018	guts	Bray et al. 2018, workshop
Perciformes	**Carangidae**	***Caranx heberi* (Bennett, 1830)**	**Digenea**	**Bucephalidae**	***Bucephalus* sp.**	**intestine**	**Present study**
Perciformes	**Carangidae**	***Caranx heberi* (Bennett, 1830)**	**Digenea**	**Hemiuridae**	***Lecithocladium* sp.**	**stomach**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Caranx heberi* (Bennett, 1830)**	**Digenea**	**nr**	**Digenea indet.**	**musculature**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Caranx heberi* (Bennett, 1830)**	**Monogenea**	**(Polyopisthocotylea)**	**Polyopisthocotylea indet.**	**gills**	**Present study**
Perciformes	**Carangidae**	***Caranx heberi* (Bennett, 1830)**	**Monogenea**	**Protomicrocotylidae**	***Protomicrocotyle* sp.**	**gills**	**Present study**
Perciformes	**Carangidae**	***Caranx heberi* (Bennett, 1830)**	**Nematoda**	**Gnathostomatidae**	***Echinocephalus* sp.**	**stomach wall**	**Present study**
Perciformes	**Carangidae**	***Caranx heberi* (Bennett, 1830)**	**Nematoda**	**nr**	**Nematoda indet.**	**guts**	**Present study**
Perciformes	Carangidae	*Caranx sexfasciatus* Quoy & Gaimard, 1825	Cestoda	Lacistorhynchidae	*Dasyrhynchus variouciatus* (Pintner, 1913) Pintner, 1929	brain	Palm 2004
Perciformes	Carangidae	*Caranx sexfasciatus* Quoy & Gaimard, 1825	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	stomach wall	Palm 2004
Perciformes	Carangidae	*Caranx sexfasciatus* Quoy & Gaimard, 1825	Crustacea: Copepoda	Caligidae	*Caligus* cf. *confusus* Pillai, 1961	gills	Yuniar 2005
Perciformes	Carangidae	*Caranx sexfasciatus* Quoy & Gaimard, 1825	Crustacea: Copepoda	Caligidae	*Caligus* cf. *confusus* Pillai, 1961	gills	Yuniar et al. 2007
Perciformes	Carangidae	*Caranx sexfasciatus* Quoy & Gaimard, 1825	Crustacea: Copepoda	Caligidae	*Caligus robustus* Bassett-Smith, 1898	nr	Cressey 1991
Perciformes	Carangidae	*Caranx sexfasciatus* Quoy & Gaimard, 1825	Crustacea: Copepoda	Pennellidae	cf. *Propeniculus scomberi* (Gnanamuthu, 1951)	fins	Yuniar 2005
Perciformes	Carangidae	*Caranx sexfasciatus* Quoy & Gaimard, 1825	Crustacea: Copepoda	Pennellidae	cf. *Propeniculus scomberi* (Gnanamuthu, 1951)	fins	Yuniar et al. 2007
Perciformes	Carangidae	*Caranx sexfasciatus* Quoy & Gaimard, 1825	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Yuniar 2005

Perciformes	Carangidae	*Caranx sexfasciatus* Quoy & Gaimard, 1825	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Yuniar et al. 2007
Perciformes	Carangidae	*Caranx sexfasciatus* Quoy & Gaimard, 1825	Monogenea	Axinidae	Axinidae indet.	gills	Rückert et al. 2009a
Perciformes	Carangidae	*Caranx sexfasciatus* Quoy & Gaimard, 1825	Monogenea	Axinidae	Axinidae indet.	gills	Yuniar 2005
Perciformes	Carangidae	*Caranx sexfasciatus* Quoy & Gaimard, 1825	Nematoda	Anisakidae	*Anisakis* sp.[30]	stomach wall	Rückert et al. 2009a
Perciformes	Carangidae	*Caranx sexfasciatus* Quoy & Gaimard, 1825	Nematoda	Anisakidae	*Anisakis* sp.[30]	stomach wall	Yuniar 2005
Perciformes	Carangidae	*Caranx* sp.	Crustacea: Copepoda	Caligidae	*Caligus confusus* Pillai, 1961	gills	Yamaguti 1954d
Perciformes	Carangidae	*Caranx* sp.	Crustacea: Copepoda	Caligidae	*Caligus epinepheli* Yamaguti, 1936	gills	Yamaguti 1954d
Perciformes	Carangidae	*Caranx* sp.	Crustacea: Isopoda	Cymothoidae	*Aegathoa elongata*[56] Monod, 1976	nr	Trilles 1979
Perciformes	Carangidae	*Caranx* sp.	Digenea	Bucephalidae	*Bucephalus margaritae* Ozaki & Ishibashi, 1934	stomach	Bray et al. 2018
Perciformes	Carangidae	*Caranx* sp.	Digenea	Bucephalidae	*Bucephalus margaritae* Ozaki & Ishibashi, 1934	stomach	Yamaguti 1952
Perciformes	Carangidae	*Caranx* sp.	Digenea	Didymozoidae	*Unitubulotestis carangis* Yamaguti, 1953	pharynx	Yamaguti 1953b
Perciformes	Carangidae	*Caranx* sp.	Digenea	Hemiuridae	*Plerurus digitatus* (Looss, 1899) Looss, 1907	stomach	Yamaguti 1952
Perciformes	Carangidae	*Caranx* sp.	Digenea	Lecithasteridae	*Aponurus carangis* Yamaguti, 1952	stomach	Yamaguti 1952
Perciformes	Carangidae	*Caranx* sp.	Digenea	Monorchiidae	*Ophisthomonorchis carangis* Yamaguti, 1952	pyloric caeca	Yamaguti 1952
Perciformes	Carangidae	*Caranx* sp.	Monogenea	Heteromicrocotylidae	*Heteromicrocotyla carangis* Yamaguti, 1953	gills	Yamaguti 1953a
Perciformes	Carangidae	*Caranx* sp.	Monogenea	Protomicrocotylidae	*Protomicrocotyle celebesensis* Yamaguti, 1953	gills	Yamaguti 1953a
Perciformes	Carangidae	*Caranx* sp.	Nematoda	Anisakidae	*Anisakis* sp.[30]	nr	Anshary et al. 2014
Perciformes	Carangidae	*Caranx* sp.	Nematoda	Rhadinorhynchidae	*Gorgorhynchus celebesensis* (Yamaguti, 1954)	intestine	Yamaguti 1954b
Perciformes	Carangidae	*Decapterus kurroides* Bleeker, 1855	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1983
Perciformes	Carangidae	*Decapterus kurroides* Bleeker, 1855	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm & Theisen et al. 2017
Perciformes	Carangidae	*Decapterus kurroides* Bleeker, 1855	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm et al. 2008
Perciformes	Carangidae	*Decapterus macarellus* (Cuvier, 1833)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Koinari et al. 2013
Perciformes	Carangidae	*Decapterus macarellus* (Cuvier, 1833)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017
Perciformes	**Carangidae**	***Decapterus macrosoma* Bleeker, 1851**	**Acanthocephala**	**nr**	**Acanthocephala indet. spp. (two species)**	**on intestine**	**Present study**
Perciformes	**Carangidae**	***Decapterus macrosoma* Bleeker, 1851**	**Cestoda**	**Tentaculariidae**	***Nybelinia africana* Dollfus, 1960**	**stomach wall**	**Present study**
Perciformes	**Carangidae**	***Decapterus macrosoma* Bleeker, 1851**	**Digenea**	**Hemiuridae**	***Ectenurus* cf. *selari* (Parukhin, 1966)**	**stomach**	**Present study**
Perciformes	**Carangidae**	***Decapterus macrosoma* Bleeker, 1851**	**Digenea**	**Hemiuridae**	**Hemiuridae indet.**	**stomach**	**Present study**
Perciformes	**Carangidae**	***Decapterus macrosoma* Bleeker, 1851**	**Digenea**	**Hemiuridae**	***Hemiurus* sp.**	**stomach**	**Present study**
Perciformes	**Carangidae**	***Decapterus macrosoma* Bleeker, 1851**	**Digenea**	**nr**	**Digenea indet. spp. (three species/morphotypes)**	**stomach**	**Present study**
Perciformes	**Carangidae**	***Decapterus macrosoma* Bleeker, 1851**	**Monogenea**	**(Polyopisthocotylea)**	**Polyopisthocotylea indet.**	**gills**	**Present study**
Perciformes	Carangidae	*Decapterus macrosoma* Bleeker, 1851	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	mesenteries	Palm & Theisen et al. 2017
Perciformes	**Carangidae**	***Decapterus macrosoma* Bleeker, 1851**	**Nematoda**	**nr**	**Nematoda indet.**	**guts**	**Present study**
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	guts	Fitriyanti 2000
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus* sp.	gills	Fitriyanti 2000
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Digenea	Lecithasteridae	*Hysterolecitha* sp.	stomach	Fitriyanti 2000
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Digenea	Lecithasteridae	*Parhemiurus* sp.	stomach	Fitriyanti 2000
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Monogenea	Axinidae	*Axine (Lintaxine?)* sp.	gills	Fitriyanti 2000
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Monogenea	Mazocraeidae	*Mazocraes* sp.	gills	Fitriyanti 2000
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1983
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Fitriyanti 2000

Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1978
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Fitriyanti 2000
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Hadidjaja et al. 1978
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Hutomo et al. 1978
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Ilahude et al. 1978
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Ilahude et al. 1978
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Martosewojo 1980
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Palm & Theisen et al. 2017
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Palm et al. 2008
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Walter et al. 2000
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Hadidjaja et al. 1978
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Hutomo et al. 1978
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Ilahude et al. 1978
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Martosewojo 1980
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Cystidicolidae	*Spinitectus* sp.	stomach wall	Fitriyanti 2000
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Physalopteridae	Physalopteridae indet.	body cavity	Fitriyanti 2000
Perciformes	**Carangidae**	***Decapterus russelli* (Rüppel, 1830)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**mesenteries**	**Present study, workshop Bali**
Perciformes	Carangidae	*Decapterus russelli* (Rüppel, 1830)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	body cavity	Yamaguti 1954c
Perciformes	Carangidae	*Decapterus* spp.	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802		Palm 2004
Perciformes	Carangidae	*Decapterus* spp.	Digenea	Hemiuridae	*Lecithochirium* sp.	nr	Susanti 2008
Perciformes	Carangidae	*Decapterus* spp.	Digenea	Hemiuridae	*Lecithocladium* sp.	nr	Susanti 2008
Perciformes	Carangidae	*Decapterus* spp.	Digenea	Hemiuridae	*Mecoderus* sp.	nr	Susanti 2008
Perciformes	Carangidae	*Decapterus* spp.	Digenea	nr	Digenea indet.	nr	Susanti 2008
Perciformes	Carangidae	*Decapterus* spp.	Monogenea	Hexostomatidae	*Hexostoma* sp.	nr	Susanti 2008
Perciformes	Carangidae	*Decapterus* spp.	Nematoda	Anisakidae	Anisakidae indet.	nr	Susanti 2008
Perciformes	Carangidae	*Decapterus* spp.	Nematoda	Anisakidae	*Anisakis* sp.[30]	nr	Susanti 2008
Perciformes	**Carangidae**	***Decapterus tabl* Berry, 1968**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**intestine**	**Present study**
Perciformes	**Carangidae**	***Decapterus tabl* Berry, 1968**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Decapterus tabl* Berry, 1968**	**Cestoda**	**Tentaculariidae**	***Nybelinia africana* Dollfus, 1960**	**stomach wall**	**Present study**
Perciformes	**Carangidae**	***Decapterus tabl* Berry, 1968**	**Cestoda**	**Tentaculariidae**	***Nybelinia indica* Chandra, 1986**	**body cavity**	**Present study**
Perciformes	**Carangidae**	***Decapterus tabl* Berry, 1968**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study**
Perciformes	**Carangidae**	***Decapterus tabl* Berry, 1968**	**Digenea**	**nr**	**Digenea indet.**	**guts**	**Present study**
Perciformes	**Carangidae**	***Decapterus tabl* Berry, 1968**	**Digenea**	**Opecoelidae**	**Opecoelidae indet.**	**intestine**	**Present study, workshop Bali**
Perciformes	Carangidae	*Decapterus tabl* Berry, 1968	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	gonads	Palm & Theisen et al. 2017, workshop
Perciformes	Carangidae	*Decapterus tabl* Berry, 1968	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	gonads	Palm & Theisen et al. 2017, workshop
Perciformes	**Carangidae**	***Decapterus tabl* Berry, 1968**	**Nematoda**	**nr**	**Nematoda indet.**	**body cavity**	**Present study**
Perciformes	Carangidae	*Elagatis bipinnulata* (Quoy & Gaimard, 1825)	Crustacea: Copepoda	Caligidae	*Caligus confusus* Pillai, 1961	gills	Yamaguti 1954d
Perciformes	Carangidae	*Elagatis bipinnulata* (Quoy & Gaimard, 1825)	Monogenea	Gotocotylidae	*Gotocotyla elagatis* Meserve, 1938	gills	Hayward & Rohde 1999b
Perciformes	Carangidae	*Elagatis bipinnulata* (Quoy & Gaimard, 1825)	Monogenea	Gotocotylidae	*Gotocotyla elagatis* Meserve, 1938	gills	Yamaguti 1953a
Perciformes	**Carangidae**	***Gnathanodon speciosus* (Forsskål, 1775)**	**Cestoda**	**nr**	**Trypanorhyncha indet.**	**guts**	**Present study, workshop Bali**

Perciformes	**Carangidae**	***Gnathanodon speciosus* (Forsskål, 1775)**	**Monogenea**	**Capsalidae**	***Encotyllabe* sp.**	**pharynx**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Acanthocephala**	**Cavisomidae**	***Filisoma* sp.**	**on intestine**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	mesenteries	Palm 2004
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Zainurrahman 2013
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Cestoda**	**Lacistorhynchidae**	***Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931**	**body cavity**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Cestoda	nr	Trypanorhyncha indet.	guts	Zainurrahman 2013
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Cestoda**	**nr**	**Trypanorhyncha indet.**	**guts**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Crustacea: Copepoda	Caligidae	*Caligus cordyla* Pillai, 1963	gills	Theisen 2009
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Crustacea: Copepoda	Caligidae	*Caligus cordyla* Pillai, 1963	gills	Zainurrahman 2013
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus cordyla* Pillai, 1963**	**gills**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Crustacea: Copepoda	Caligidae	*Caligus longipedis* Bassett-Smith, 1898	gills	Theisen 2009
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus longipedis* Bassett-Smith, 1898**	**gills**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus corniger* Yamaguti, 1954	gills	Yamaguti 1954d
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus corniger* Yamaguti, 1954	gills	Zainurrahman 2013
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus corniger* Yamaguti, 1954**	**gills**	**Present study**
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Crustacea: Copepoda**	**Pennellidae**	**Pennellidae indet.**	**gills**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Digenea	Acanthocolpidae	cf. *Stephanostomum* sp.	stomach	Zainurrahman 2013
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Digenea**	**Acanthocolpidae**	**cf. *Stephanostomum* sp.**	**stomach**	**Present study**
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Digenea**	**Bucephalidae**	***Bucephalus* cf. *fragilis* Velasquez, 1959**	**stomach**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Digenea	Bucephalidae	*Echinostoma* sp.[5]	stomach	Zainurrahman 2013
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Digenea	Bucephalidae	*Prosorhynchus* sp.	guts	Zainurrahman 2013
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Digenea**	**Bucephalidae**	***Prosorhynchus* sp.**	**guts**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Digenea	Hemiuridae	*Lecithocladium megalaspis* Yamaguti, 1953	stomach	Yamaguti 1953b
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Digenea**	**Hemiuridae**	***Lecithocladium megalaspis* Yamaguti, 1953**	**stomach**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Digenea	Lecithasteridae	*Aponurus laguncula* Loos, 1907	intestine	Yamaguti 1953b
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Monogenea**	**(Monopisthocotylea)**	**Monopisthocotylea indet.**	**gills**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Monogenea	Protomicrocotylidae	*Bilaterocotyloides carangis* Ramalingam, 1961	gills	Theisen 2009
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Monogenea	Protomicrocotylidae	*Bilaterocotyloides carangis* Ramalingam, 1961	gills	Zainurrahman 2013
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Monogenea**	**Protomicrocotylidae**	***Bilaterocotyloides carangis* Ramalingam, 1961**	**gills**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Monogenea	Protomicrocotylidae	*Bilaterocotyloides* sp.	gills	Zainurrahman 2013
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Monogenea**	**Protomicrocotylidae**	***Bilaterocotyloides* sp.**	**gills**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	gonads	Palm & Theisen et al. 2017, workshop
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Nematoda	Camallanidae	*Camallanus* cf. *carangis* Olsen, 1954	intestine	Theisen 2009
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Nematoda**	**Camallanidae**	***Camallanus* cf. *carangis* Olsen, 1954**	**intestine**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Nematoda	Camallanidae	*Camallanus* sp.[32]	intestine	Zainurrahman 2013
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Nematoda	Philometridae	*Philometra lateolabracis*[29] (Yamaguti, 1935) Yamaguti, 1961	gonads	Zainurrahman 2013
Perciformes	**Carangidae**	***Megalaspis cordyla* (L.)**	**Nematoda**	**Philometridae**	***Philometra* sp.**	**gonads**	**Present study**
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.[28]	intestine	Theisen 2009
Perciformes	Carangidae	*Megalaspis cordyla* (L.)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	pyloric caeca	Theisen 2009
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Crustacea: Copepoda	Bomolochidae	*Bomolochus megaceros* Heller, 1865	gills	Heller 1865

Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Crustacea: Copepoda	Bomolochidae	*Bomolochus megaceros* Heller, 1865	gills	Iman 2012
Perciformes	**Carangidae**	***Parastromateus niger* (Bloch, 1795)**	**Crustacea: Copepoda**	**Bomolochidae**	***Bomolochus megaceros* Heller, 1865**	**gills**	**Present study**
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Crustacea: Copepoda	Caligidae	*Synestius caliginus* Steenstrup & Lütken, 1861	gills	Dojiri & Ho 2013
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Crustacea: Copepoda	Caligidae	*Synestius caliginus* Steenstrup & Lütken, 1861	gills	Dojiri 1983
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Crustacea: Copepoda	Caligidae	*Synestius caliginus* Steenstrup & Lütken, 1861	gills	Iman 2012
Perciformes	**Carangidae**	***Parastromateus niger* (Bloch, 1795)**	**Crustacea: Copepoda**	**Caligidae**	***Synestius caliginus* Steenstrup & Lütken, 1861**	**gills**	**Present study, workshop Bali**
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Crustacea: Copepoda	Lernaeopodidae	*Thysanote appendiculata* (Steenstrup & Lütken, 1861)	gills	Iman 2012
Perciformes	**Carangidae**	***Parastromateus niger* (Bloch, 1795)**	**Crustacea: Copepoda**	**Lernaeopodidae**	***Thysanote appendiculata* (Steenstrup & Lütken, 1861)**	**gills**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Parastromateus niger* (Bloch, 1795)**	**Crustacea: Copepoda**	**Pennellidae**	**Pennellidae indet.**	**gills**	**Present study**
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Bleeker 1857
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Nierstrasz 1915
Perciformes	**Carangidae**	***Parastromateus niger* (Bloch, 1795)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Parastromateus niger* (Bloch, 1795)**	**Digenea**	**Acanthocolpidae**	**Acanthocolpidae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Digenea	Bucephalidae	*Prosorhynchus* sp.	guts	Iman 2012
Perciformes	**Carangidae**	***Parastromateus niger* (Bloch, 1795)**	**Digenea**	**Bucephalidae**	***Prosorhynchus* sp.**	**guts**	**Present study**
Perciformes	**Carangidae**	***Parastromateus niger* (Bloch, 1795)**	**Digenea**	**Hemiuridae**	***Lecithocladium apolecti* Velasquez, 1962**	**stomach**	**Present study, workshop Bali**
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Digenea	Hemiuridae	*Lecithocladium* sp.[13]	stomach	Iman 2012
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Digenea	Lecithasteridae	*Aponurus* sp.	stomach	Iman 2012
Perciformes	**Carangidae**	***Parastromateus niger* (Bloch, 1795)**	**Digenea**	**Lecithasteridae**	***Aponurus* sp.**	**stomach**	**Present study**
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Digenea	Monorchiidae	*Opisthomonorcheides ovacutus* (Mamaev, 1970) Machida, 2011	intestine	Bray et al. 2017
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Digenea	Monorchiidae	*Opisthomonorcheides pampi* (Wang, 1982) Liu et al. 2010	intestine	Bray et al. 2017
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Digenea	Monorchiidae	*Opisthomonorcheides* sp.[18]	intestine	Iman 2012
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Monogenea	Axinidae	*Lintaxine* sp.	gills	Iman 2012
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Monogenea	Axinidae	*Lintaxine* sp.	gills	Sirikan 1981
Perciformes	**Carangidae**	***Parastromateus niger* (Bloch, 1795)**	**Monogenea**	**Axinidae**	***Lintaxine* sp.**	**gills**	**Present study**
Perciformes	**Carangidae**	***Parastromateus niger* (Bloch, 1795)**	**Myxozoa: Myxosporea**	**Myxobolidae**	***Henneguya* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	Carangidae	*Parastromateus niger* (Bloch, 1795)	Nematoda	Philometridae	*Philometra* sp.	gonads	Iman 2012
Perciformes	**Carangidae**	***Parastromateus niger* (Bloch, 1795)**	**Nematoda**	**Philometridae**	***Philometra* sp.**	**gonads**	**Present study**
Perciformes	Carangidae	*Scomberoides commersonnianus* Lacepède, 1801	Cestoda	Tentacularidae	*Tentacularia coryphaenae* Bosc, 1802	stomach	Palm 2004
Perciformes	Carangidae	*Scomberoides lysan* (Forsskål, 1775)	Crustacea: Copepoda	Caligidae	*Caligus epinepheli* Yamaguti, 1936	gills	Yamaguti 1954d
Perciformes	Carangidae	*Scomberoides lysan* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus chorinemi* Yamaguti, 1952	pyloric caeca	Bray et al. 2018
Perciformes	Carangidae	*Scomberoides lysan* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus chorinemi* Yamaguti, 1952	pyloric caeca	Yamaguti 1952
Perciformes	Carangidae	*Scomberoides lysan* (Forsskål, 1775)	Monogenea	Allodiscocotylidae	*Allodiscocotyla chorinemi* Yamaguti, 1953	gills	Yamaguti 1953a
Perciformes	Carangidae	*Scomberoides lysan* (Forsskål, 1775)	Monogenea	Allodiscocotylidae	*Metacamopia chorinemi* (Yamaguti, 1953) Lebedev, 1984	gills	Yamaguti 1953a
Perciformes	Carangidae	*Scomberoides lysan* (Forsskål, 1775)	Nematoda	Anisakidae	cf. *Terranova* sp.	body cavity	Yamaguti 1954c
Perciformes	Carangidae	*Scomberoides lysan* (Forsskål, 1775)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	body cavity	Yamaguti 1954c
Perciformes	Carangidae	*Scomberoides tol* (Cuvier, 1832)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Rahmawati 2013
Perciformes	**Carangidae**	***Scomberoides tol* (Cuvier, 1832)**	**Cestoda**	**Lacistorhynchidae**	***Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931**	**body cavity**	**Present study**
Perciformes	Carangidae	*Scomberoides tol* (Cuvier, 1832)	Digenea	Bucephalidae	*Bucephalus* sp.	intestine	Rahmawati 2013
Perciformes	**Carangidae**	***Scomberoides tol* (Cuvier, 1832)**	**Digenea**	**Bucephalidae**	***Bucephalus* sp.**	**intestine**	**Present study**

Perciformes	Carangidae	*Scomberoides tol* (Cuvier, 1832)	Digenea	Bucephalidae	*Prosorhynchus* sp.	guts	Rahmawati 2013
Perciformes	**Carangidae**	***Scomberoides tol* (Cuvier, 1832)**	**Digenea**	**Bucephalidae**	***Prosorhynchus* sp.**	**guts**	**Present study**
Perciformes	Carangidae	*Scomberoides tol* (Cuvier, 1832)	Digenea	Didymozoidae	Didymozoidae indet. spp. (two species)	guts	Rahmawati 2013
Perciformes	**Carangidae**	***Scomberoides tol* (Cuvier, 1832)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet. spp. (two species)**	**guts**	**Present study**
Perciformes	Carangidae	*Scomberoides tol* (Cuvier, 1832)	Digenea	Hemiuridae	Hemiuridae indet. spp. (two species/morphotypes)	guts	Rahmawati 2013
Perciformes	**Carangidae**	***Scomberoides tol* (Cuvier, 1832)**	**Digenea**	**Hemiuridae**	**Hemiuridae indet. spp. (two species/morphotypes)**	**guts**	**Present study**
Perciformes	Carangidae	*Scomberoides tol* (Cuvier, 1832)	Monogenea	Mazocraeidae	Mazocraeidea indet.	gills	Rahmawati 2013
Perciformes	**Carangidae**	***Scomberoides tol* (Cuvier, 1832)**	**Monogenea**	**Mazocraeidae**	**Mazocraeidea indet.**	**gills**	**Present study**
Perciformes	Carangidae	*Scomberoides tol* (Cuvier, 1832)	Monogenea	Microcotylidae	cf. *Heterapta* sp. (one of two largest Monogenea from present study)	gills	Rahmawati 2013
Perciformes	**Carangidae**	***Scomberoides tol* (Cuvier, 1832)**	**Monogenea**	**Microcotylidae**	**cf. *Heterapta* sp. (one of two largest Monogenea from present study)**	**gills**	**Present study**
Perciformes	Carangidae	*Scomberoides tol* (Cuvier, 1832)	Nematoda	Anisakidae	*Anisakis* sp.[30]	guts	Rahmawati 2013
Perciformes	Carangidae	*Scomberoides tol* (Cuvier, 1832)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	guts	Palm & Theisen et al. 2017, workshop
Perciformes	Carangidae	*Scomberoides tol* (Cuvier, 1832)	Nematoda	Anisakidae	*Terranova* sp.	mesenteries	Rahmawati 2013
Perciformes	**Carangidae**	***Scomberoides tol* (Cuvier, 1832)**	**Nematoda**	**Anisakidae**	***Terranova* sp.**	**mesenteries**	**Present study**
Perciformes	Carangidae	*Scomberoides tol* (Cuvier, 1832)	Nematoda	Camallanidae	*Camallanus* sp.	intestine	Rahmawati 2013
Perciformes	**Carangidae**	***Scomberoides tol* (Cuvier, 1832)**	**Nematoda**	**Camallanidae**	***Camallanus* sp.**	**intestine**	**Present study**
Perciformes	Carangidae	*Scomberoides tol* (Cuvier, 1832)	Nematoda	Philometridae	*Philometra* sp.	liver	Rahmawati 2013
Perciformes	**Carangidae**	***Scomberoides tol* (Cuvier, 1832)**	**Nematoda**	**Philometridae**	***Philometra* sp.**	**liver**	**Present study**
Perciformes	Carangidae	*Scomberoides tol* (Cuvier, 1832)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	body cavity	Rahmawati 2013
Perciformes	**Carangidae**	***Scomberoides tol* (Cuvier, 1832)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**body cavity**	**Present study**
Perciformes	Carangidae	*Selar boops* (Cuvier, 1833)	Crustacea: Isopoda	Cymothoidae	*Norileca indica* (H. Milne Edwards, 1840)	gill cavity	Wibisono 2012
Perciformes	**Carangidae**	***Selar boops* (Cuvier, 1833)**	**Crustacea: Isopoda**	**Cymothoidae**	***Norileca indica* (H. Milne Edwards, 1840)**	**gill cavity**	**Present study**
Perciformes	Carangidae	*Selar boops* (Cuvier, 1833)	Digenea	Hemiuridae	*Lecithocladium* sp.	stomach	Wibisono 2012
Perciformes	**Carangidae**	***Selar boops* (Cuvier, 1833)**	**Digenea**	**Hemiuridae**	***Lecithocladium* sp.**	**stomach**	**Present study**
Perciformes	Carangidae	*Selar boops* (Cuvier, 1833)	Digenea	nr	Digenea indet. spp. (two species/morphotypes)	stomach	Wibisono 2012
Perciformes	**Carangidae**	***Selar boops* (Cuvier, 1833)**	**Digenea**	**nr**	**Digenea indet. spp. (two species/morphotypes)**	**stomach**	**Present study**
Perciformes	**Carangidae**	***Selar boops* (Cuvier, 1833)**	**Monogenea**	**Gastrocotylidae**	**cf. *Amphipolycotyle chloroscombrus* Hargis, 1957**	**gills**	**Present study**
Perciformes	Carangidae	*Selar boops* (Cuvier, 1833)	Monogenea	Gastrocotylidae	Diclidophoridae indet.[23]	gills	Wibisono 2012
Perciformes	Carangidae	*Selar boops* (Cuvier, 1833)	Nematoda	Camallanidae	*Camallanus* sp.	intestine	Wibisono 2012
Perciformes	**Carangidae**	***Selar boops* (Cuvier, 1833)**	**Nematoda**	**Camallanidae**	***Camallanus* sp.**	**intestine**	**Present study**
Perciformes	Carangidae	*Selar boops* (Cuvier, 1833)	Nematoda	Raphidascarididae	*Hysterothylacium aduncum*[28] (Rudolphi, 1802)	body cavity	Wibisono 2012
Perciformes	Carangidae	*Selar boops* (Cuvier, 1833)	Nematoda	Raphidascarididae	*Hysterothylacium fortalezae*[28]	body cavity	Wibisono 2012
Perciformes	**Carangidae**	***Selar boops* (Cuvier, 1833)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**body cavity**	**Present study**
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Cestoda**	**nr**	**Trypanorhyncha indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Cestoda**	**Tentaculariidae**	***Mixonybelinia lepturi* Palm, 2004**	**stomach**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Cestoda**	**Tentaculariidae**	***Nybelinia pseudafricana* sp. nov.**	**stomach**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Crustacea: Copepoda**	**Bomolochidae**	**Bomolochidae indet.**	**operculum**	**Present study, workshop Bali**
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Crustacea: Copepoda	Bomolochidae	*Bomolochus* sp.	gills	Wibisono 2012
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Crustacea: Copepoda**	**Bomolochidae**	***Bomolochus* sp.**	**gills**	**Present study**

Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Crustacea: Copepoda**	**Lernaeopodidae**	***Naobranchia* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Crustacea: Copepoda**	**Lernanthropidae**	**Lernanthropidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Crustacea: Isopoda	Cymothoidae	*Norileca indica* (H. Milne Edwards, 1840)	gill cavity	Sidabalok 2013
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Crustacea: Isopoda	Cymothoidae	*Norileca indica* (H. Milne Edwards, 1840)	gill cavity	Wibisono 2012
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Crustacea: Isopoda**	**Cymothoidae**	***Norileca indica* (H. Milne Edwards, 1840)**	**gill cavity**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet. spp. (two species)**	**guts**	**Present study**
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Digenea	Hemiuridae	*Ectenurus* cf. *selari* (Parukhin, 1966)	guts	Wibisono 2012
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Digenea**	**Hemiuridae**	***Ectenurus* cf. *selari* (Parukhin, 1966)**	**guts**	**Present study**
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Digenea	Hemiuridae	*Lecithocladium* sp.	stomach	Wibisono 2012
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Digenea**	**Hemiuridae**	***Lecithocladium* sp.**	**stomach**	**Present study**
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Digenea**	**Monorchiidae**	**Monorchiidae indet. spp. (two species/morphotypes)**	**guts**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Monogenea**	**Gastrocotylidae**	**cf. *Amphipolycotyle chloroscombrus* Hargis, 1957**	**gills**	**Present study**
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Monogenea	Gastrocotylidae	Diclidophoridae indet.[23]	gills	Wibisono 2012
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Myxozoa: Myxosporea**	**Kudoidae**	***Kudoa* sp.**	**stomach**	**Present study, workshop Bali**
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Nematoda	Anisakidae	*Anisakis* sp.[30]	guts	Tamba 2011 = et al. 2012
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	guts	Koinari et al. 2013
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	guts	Palm & Theisen et al. 2017, workshop
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	guts	Tamba 2011 = et al. 2012
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	guts	Palm & Theisen et al. 2017, workshop
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Nematoda	Anisakidae	*Terranova* sp.	mesenteries	Ilahude 1980
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Nematoda	Anisakidae	*Terranova* sp.	mesenteries	Ilahude et al. 1978
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Nematoda	Anisakidae	*Terranova* sp.	mesenteries	Palm et al. 2008
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Nematoda	Camallanidae	*Camallanus* cf. *carangis* Olsen, 1954	intestine	Tamba 2011 = et al. 2012
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Nematoda	Camallanidae	*Camallanus* cf. *carangis* Olsen, 1954	intestine	Wibisono 2012
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Nematoda**	**Camallanidae**	***Camallanus* cf. *carangis* Olsen, 1954**	**intestine**	**Present study**
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Nematoda**	**Capillariidae**	***Capillaria* sp.**	**intestine**	**Present study**
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Nematoda	Capillariidae	*Capillaria* sp.[33]	intestine	Wibisono 2012
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Nematoda	Raphidascarididae	*Hysterothylacium aduncum*[28] (Rudolphi, 1802)	body cavity	Wibisono 2012
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* spp. (two species/morphotypes)**	**body cavity**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Nematoda**	**Raphidascarididae**	***Raphidascaris* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	Carangidae	*Selar crumenophthalmus* (Bloch, 1793)	Nematoda	Rhadinorhynchidae	Acanthocephala indet.[47]	intestine	Tamba 2011 = et al. 2012
Perciformes	**Carangidae**	***Selar crumenophthalmus* (Bloch, 1793)**	**Nematoda**	**Rhadinorhynchidae**	**cf. *Gorgorhynchus medius***	**intestine**	**Present study**
Perciformes	**Carangidae**	***Selaroides leptolepis* (Cuvier, 1833)**	**Cestoda**	**Tentaculariidae**	***Nybelinia africana* Dollfus, 1960**	**body cavity**	**Present study**
Perciformes	**Carangidae**	***Selaroides leptolepis* (Cuvier, 1833)**	**Cestoda**	**Tentaculariidae**	***Nybelinia indica* Chandra, 1986**	**body cavity**	**Present study**
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Crustacea: Copepoda	Bomolochidae	*Bomolochus* sp.	gills	Wibisono 2012
Perciformes	**Carangidae**	***Selaroides leptolepis* (Cuvier, 1833)**	**Crustacea: Copepoda**	**Bomolochidae**	***Bomolochus* sp.**	**gills**	**Present study**
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Pardede 2000
Perciformes	**Carangidae**	***Selaroides leptolepis* (Cuvier, 1833)**	**Digenea**	**Fellodistomidae**	***Tergestia* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Digenea	Hemiuridae	Hemiuridae indet.	guts	Mulyanti 2001
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Digenea	Hemiuridae	Hemiuridae indet.	guts	Wibisono 2012

Perciformes	**Carangidae**	***Selaroides leptolepis* (Cuvier, 1833)**	**Digenea**	**Hemiuridae**	**Hemiuridae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Selaroides leptolepis* (Cuvier, 1833)**	**Digenea**	**Monorchiidae**	**Monorchiidae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Monogenea	(Monopisthocotylea)	Monopisthocotylea indet.	gills	Mulyanti 2001
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Monogenea	(Polyopisthocotylea)	Polyopisthocotylea indet.	gills	Wibisono 2012
Perciformes	**Carangidae**	***Selaroides leptolepis* (Cuvier, 1833)**	**Monogenea**	**(Polyopisthocotylea)**	**Polyopisthocotylea indet.**	**gills**	**Present study**
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Nematoda	Acuariidae	cf. *Paracuaria* sp.	body cavity	Wibisono 2012
Perciformes	**Carangidae**	***Selaroides leptolepis* (Cuvier, 1833)**	**Nematoda**	**Acuariidae**	**cf. *Paracuaria* sp.**	**body cavity**	**Present study**
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Nematoda	Anisakidae	*Anisakis* sp.[30]	guts	Utami 2014
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Nematoda	Anisakidae	*Anisakis* sp.[30]	guts	Wibisono 2012
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	guts	Palm & Theisen et al. 2017, workshop
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Nematoda	Anisakidae	*Terranova* sp.	mesenteries	Wibisono 2012
Perciformes	**Carangidae**	***Selaroides leptolepis* (Cuvier, 1833)**	**Nematoda**	**Anisakidae**	***Terranova* sp.**	**mesenteries**	**Present study**
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Nematoda	Camallanidae	*Camallanus* sp.	intestine	Pardede 2000
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Nematoda	Camallanidae	*Camallanus* sp.	intestine	Wibisono 2012
Perciformes	**Carangidae**	***Selaroides leptolepis* (Cuvier, 1833)**	**Nematoda**	**Camallanidae**	***Camallanus* sp.**	**intestine**	**Present study**
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Nematoda	Raphidascarididae	*Hysterothylacium aduncum*[28] (Rudolphi, 1802)	body cavity	Wibisono 2012
Perciformes	Carangidae	*Selaroides leptolepis* (Cuvier, 1833)	Nematoda	Raphidascarididae	*Hysterothylacium fortalezae*[28] (Klein, 1973) Deardorff & Overstreet, 1981	body cavity	Wibisono 2012
Perciformes	**Carangidae**	***Selaroides leptolepis* (Cuvier, 1833)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* spp. (two species/morphotypes)**	**body cavity**	**Present study**
Perciformes	**Carangidae**	***Trachinotus blochii* (Lacépède, 1801)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**surface**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Trachinotus blochii* (Lacépède, 1801)**	**Monogenea**	**Capsalidae**	**Capsalidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Trachinotus blochii* (Lacépède, 1801)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	**Carangidae**	***Trachinotus blochii* (Lacépède, 1801)**	**Nematoda**	**nr**	**Nematoda indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**cf. Centrolophidae**	**cf. Centrolophidae indet.**	**Crustacea: Copepoda**	**Lernaeopodidae**	**Lernaeopodidae indet.**	**caudal peduncle**	**Present study, workshop Bali**
Perciformes	**cf. Centrolophidae**	**cf. Centrolophidae indet.**	**Digenea**	**Didymozoidae**	**Didymozoidae indet. spp. (two species/morphotypes))**	**guts**	**Present study**
Perciformes	Chaetodontidae	*Chaetodon auriga* Forsskål, 1775	Digenea	Monorchiidae	*Hurleytrematoides chaetodontis* (Yamaguti, 1952) Machida, 2005	intestine	Yamaguti 1952
Perciformes	Chaetodontidae	*Chaetodon* sp.	Digenea	Fellodistomidae	*Symmetrovesicula chaetodontis* Yamaguti, 1938	intestine	Yamaguti 1953b
Perciformes	Channidae	Channidae indet. (cf. *Channa* sp., freshwater)	Cestoda	nr	Trypanorhyncha indet.	body cavity	Sachlan 1952
Perciformes	Cirrhitidae	*Cirrhitichthys oxycephalus* (Bleeker, 1855)	Crustacea: Iopoda	Cymothoidae	*Nerocila acuminata* Schiödte & Meinert, 1881	posterior to eye	Furlan et al. 2007
Perciformes	Clupeidae	*Anodontostoma chacunda* (Hamilton, 1822)	Digenea	Hemiuridae	*Aphanurus dorosomatis* Yamaguti, 1953	stomach	Yamaguti 1953b
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Cestoda	Lacistorhynchidae	*Floriceps saccatus* Cuvier, 1817	musculature	Palm 2004
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Cestoda	Otobothriidae	*Otobothrium cysticum* (Mayer, 1842)	stomach wall	Palm 2004
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	stomach wall	Palm 2004
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Cestoda	Tentacularidae	*Heteronybelinia estigmena* (Dollfus, 1960) Palm, 1999	stomach wall	Palm 2004
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Cestoda	Tentacularidae	*Heteronybelinia yamagutii* (Dollfus, 1960) Palm, 1999	stomach wall	Palm 2004
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Cestoda	Tentacularidae	*Myxonybelinia lepturi* Palm, 2004	body cavity	Palm 2004
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Cestoda	Tentacularidae	*Nybelinia africana* Dollfus, 1960	stomach wall	Palm 2004
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Cestoda	Tentacularidae	*Nybelinia indica* Chandra, 1986	stomach wall	Palm 2004
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Cestoda	Tentacularidae	*Tentacularia coryphaenae* Bosc, 1802		Palm 2004
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	body cavity	Kuhn et al. 2013
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	body cavity	Palm & Theisen et al. 2017

Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	body cavity	Palm et al. 2008
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	guts	Kuhn et al. 2013
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	guts	Palm & Theisen et al. 2017
Perciformes	Coryphaenidae	*Coryphaena hippurus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	guts	Palm et al. 2008
Perciformes	Drepaneidae	*Drepane punctata* (Linnaeus, 1758)	Monogenea	Ancyrocephalidae	*Haliotrema bilobatus* (Yamaguti, 1953) Bychowsky & Nagibina, 1970	gills	Yamaguti 1953a
Perciformes	Drepaneidae	*Drepane punctata* (Linnaeus, 1758)	Monogenea	Ancyrocephalidae	*Haliotrema spinicirrus* (Yamaguti, 1953) Bychowsky & Nagibina, 1970	gills	Yamaguti 1954d
Perciformes	Echeneidae	*Echeneis naucrates* Linnaeus, 1758	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	mesenteries	Palm 2004
Perciformes	Echeneidae	*Echeneis naucrates* Linnaeus, 1758	Crustacea: Isopoda	Cymothoidae	*Aegathoa elongata*[56] Monod, 1976	stomach (!)	Monod & Serène 1976
Perciformes	Echeneidae	*Echeneis naucrates* Linnaeus, 1758	Crustacea: Isopoda	Cymothoidae	*Aegathoa elongata*[56] Monod, 1976	stomach (!)	Monod 1976
Perciformes	Echeneidae	*Echeneis naucrates* Linnaeus, 1758	Crustacea: Isopoda	Cymothoidae	*Aegathoa elongata*[56] Monod, 1976	stomach (!)	Sidabalok 2013
Perciformes	Ephippidae	*Platax teira* (Forsskål, 1775)	Crustacea: Copepoda	Caligidae	*Anuretes branchialis* Rangnekar, 1953	gills	Dojiri & Ho 2013
Perciformes	Ephippidae	*Platax teira* (Forsskål, 1775)	Crustacea: Copepoda	Caligidae	*Anuretes branchialis* Rangnekar, 1953	gills	Dojiri 1983
Perciformes	**Ephippidae**	***Platax teira* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Caligidae**	***Anuretes branchialis* Rangnekar, 1953**	**gills**	**Present study, workshop Bali**
Perciformes	**Ephippidae**	***Platax teira* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Caligidae**	***Anuretes* sp.**[55]	**gills**	**Present study, workshop Bali**
Perciformes	**Ephippidae**	***Platax teira* (Forsskål, 1775)**	**Monogenea**	**Capsalidae**	**Capsalidae indet.**	**surface**	**Present study, workshop Bali**
Perciformes	**Ephippidae**	***Platax teira* (Forsskål, 1775)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	**Ephippidae**	***Platax teira* (Forsskål, 1775)**	**Nematoda**	**nr**	**Nematoda indet.**	**guts**	**Present study, workshop Bali**
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Acanthocephala	Rhabdochonidae	Rhabdochonidae indet.	body cavity	Jakob & Palm 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Acanthocephala	Rhabdochonidae	Rhabdochonidae indet.	body cavity	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Jakob & Palm 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Lacistorhynchidae	*Floriceps saccatus* Cuvier, 1817	body cavity	Jakob & Palm 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Lacistorhynchidae	*Floriceps saccatus* Cuvier, 1817	body cavity	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Lacistorhynchidae	*Floriceps saccatus* Cuvier, 1817	body cavity	Palm 2004
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	nr	Cestoda indet.	nr	Jakob & Palm 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	nr	Cestoda indet.	nr	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Sphyriocephalidae	*Hepatoxylon trichiuri* (Holten, 1802) Bosc, 1811	body cavity	Jakob & Palm 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Sphyriocephalidae	*Hepatoxylon trichiuri* (Holten, 1802) Bosc, 1811	body cavity	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Sphyriocephalidae	*Hepatoxylon trichiuri* (Holten, 1802) Bosc, 1811	body cavity	Palm 2004
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Heteronybelinia yamagutii* (Dollfus, 1960) Palm, 1999	stomach wall	Jakob & Palm 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Heteronybelinia yamagutii* (Dollfus, 1960) Palm, 1999	stomach wall	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Heteronybelinia yamagutii* (Dollfus, 1960) Palm, 1999	body cavity	Palm 2004
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Mixonybelinia lepturi* Palm, 2004	nr	Jakob & Palm 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Mixonybelinia lepturi* Palm, 2004	nr	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Mixonybelinia lepturi* Palm, 2004	body cavity	Palm 2004
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Nybelinia africana* Dollfus, 1960	stomach wall	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Nybelinia africana* Dollfus, 1960	stomach wall	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Nybelinia africana* Dollfus, 1960	body cavity	Palm 2004
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	stomach wall	Jakob & Palm 2006

Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	stomach wall	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	body cavity	Palm 2004
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	musculature	Jakob & Palm 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	musculature	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	nr	Palm 2004
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	Tentaculariidae indet.	stomach wall	Jakob & Palm 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Cestoda	Tentaculariidae	Tentaculariidae indet.	stomach wall	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Digenea	Hemiuridae	*Lecithocladium* sp.	stomach	Jakob & Palm 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Digenea	Hemiuridae	*Lecithocladium* sp.	stomach	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Nematoda	Acanthocheilidae	*Pseudanisakis* sp.	body cavity	Jakob & Palm 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Nematoda	Acanthocheilidae	*Pseudanisakis* sp.	body cavity	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Jakob & Palm 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm & Theisen et al. 2017
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm et al. 2008
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Nematoda	nr	Nematoda indet.	pyloric caeca	Rückert 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Nematoda	Rhadinorhynchidae	*Gorgorhynchus* cf. *robertdollfusi* Golvan, 1956	body cavity	Jakob & Palm 2006
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Nematoda	Rhadinorhynchidae	*Gorgorhynchus* cf. *robertdollfusi* Golvan, 1956	body cavity	Jakob 2005
Perciformes	Gempylidae	*Gempylus serpens* Cuvier, 1829	Nematoda	Rhadinorhynchidae	*Rhadinorhynchus pristis* (Rudolphi, 1802)	nr	Verweyen et al. 2011
Perciformes	Gempylidae	*Lepidocybium flavobrunneum* (Smith, 1843)	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	nr	Palm 2004
Perciformes	Gempylidae	*Ruvettus pretiosus* Cocco, 1833	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	nr	Palm 2004
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Jakob & Palm 2006
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Jakob 2005
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	Tentaculariidae	*Heteronybelinia yamagutii* (Dollfus, 1960) Palm, 1999	stomach wall	Jakob & Palm 2006
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	Tentaculariidae	*Heteronybelinia yamagutii* (Dollfus, 1960) Palm, 1999	stomach wall	Jakob 2005
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	Tentaculariidae	*Heteronybelinia yamagutii* (Dollfus, 1960) Palm, 1999	body cavity	Palm 2004
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	Tentaculariidae	*Mixonybelinia lepturi* Palm, 2004	stomach wall	Jakob & Palm 2006
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	Tentaculariidae	*Mixonybelinia lepturi* Palm, 2004	stomach wall	Jakob 2005
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	Tentaculariidae	*Mixonybelinia lepturi* Palm, 2004	body cavity	Palm 2004
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	Tentaculariidae	*Nybelinia africana* Dollfus, 1960	body cavity	Palm 2004
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	musculature	Jakob & Palm 2006
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	musculature	Jakob 2005
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	stomach wall	Palm 2004
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	Tentaculariidae	Tentaculariidae indet.	stomach wall	Jakob & Palm 2006
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Cestoda	Tentaculariidae	Tentaculariidae indet.	stomach wall	Jakob 2005
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Crustacea: Copepoda	Hatschekiidae	*Hatschekia* sp.	gills	Jakob & Palm 2006
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Crustacea: Copepoda	Hatschekiidae	*Hatschekia* sp.	gills	Jakob 2005
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Digenea	Bucephalidae	*Prosorhynchoides* sp.	stomach	Jakob & Palm 2006
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Digenea	Bucephalidae	*Prosorhynchoides* sp.	stomach	Jakob 2005
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Digenea	Bucephalidae	*Rhipidocotyle danai* Bray & Palm, 2009	intestine	Bray & Palm 2009

Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Digenea	Bucephalidae	*Rhipidocotyle danai* Bray & Palm, 2009	intestine	Bray et al. 2018
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Jakob & Palm 2006
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Jakob 2005
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm & Theisen et al. 2017
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm et al. 2008
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Nematoda	nr	Nematoda indet.	mesenteries	Rückert 2006
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Nematoda	Raphidascarididae	*Raphidascaris* sp.	stomach wall	Jakob & Palm 2006
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Nematoda	Raphidascarididae	*Raphidascaris* sp.	stomach wall	Jakob 2005
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Nematoda	Rhadinorhynchidae	*Gorgorhynchus* cf. *robertdollfusi* Golvan, 1956	mesenteries	Jakob & Palm 2006
Perciformes	Gempylidae	*Thyrsitoides marleyi* Fowler, 1929	Nematoda	Rhadinorhynchidae	*Gorgorhynchus* cf. *robertdollfusi* Golvan, 1956	mesenteries	Jakob 2005
Perciformes	**Gerreidae**	***Gerres filamentosus* (Cuvier, 1829)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**surface**	**Present study, workshop Bali**
Perciformes	Gerreidae	*Gerres filamentosus* (Cuvier, 1829)	Digenea	Apocreadiidae	*Marsupioacetabulum marinum* Yamaguti, 1952	intestine	Yamaguti 1952
Perciformes	**Gerreidae**	***Gerres filamentosus* (Cuvier, 1829)**	**Monogenea**	**(Polyopisthocotylea)**	**Polyopisthocotylea indet.**	**gills**	**Present study, workshop Bali**
Perciformes	Gerreidae	*Gerres filamentosus* (Cuvier, 1829)	Monogenea	Ancyrocephalidae	*Ancyrocephalus macrogaster* Yamaguti, 1953	gills	Yamaguti 1953a
Perciformes	**Gerreidae**	***Gerres filamentosus* (Cuvier, 1829)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	Gerreidae	*Gerres oblongus* Cuvier, 1830	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	guts	Koinari et al. 2013
Perciformes	Gerreidae	*Gerres oblongus* Cuvier, 1830	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	guts	Palm & Theisen et al. 2017
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Cestoda	nr	Cestoda indet.	nr	Rückert 2006
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Cestoda	nr	Cestoda indet.	nr	Rückert et al. 2009b
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Crustacea: Copepoda	Caligidae	Caligidae indet.	gills	Rückert 2006
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Crustacea: Copepoda	Caligidae	Caligidae indet.	gills	Rückert et al. 2009b
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus longicervis* (Pillai, 1963)	gills	Rückert 2006
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus longicervis* (Pillai, 1963)	gills	Rückert et al. 2009b
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert 2006
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert et al. 2009b
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Digenea	Didymozoidae	Didymozoidae indet.	body cavity	Rückert 2006
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Digenea	Didymozoidae	Didymozoidae indet.	body cavity	Rückert et al. 2009b
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Digenea	Hemiuridae	*Aphanurus* sp.	stomach	Rückert 2006
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Digenea	Hemiuridae	*Aphanurus* sp.	stomach	Rückert et al. 2009b
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Digenea	nr	Digenea indet.	intestine	Rückert 2006
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Digenea	nr	Digenea indet.	intestine	Rückert et al. 2009b
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Monogenea	Gastrocotylidae	*Gastrocotyle indica* Subhapradha, 1951	gills	Rückert 2006
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Monogenea	Gastrocotylidae	*Gastrocotyle indica* Subhapradha, 1951	gills	Rückert et al. 2009b
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Monogenea	Microcotylidae	*Microcotyle* sp.	gills	Rückert 2006
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Monogenea	Microcotylidae	*Microcotyle* sp.	gills	Rückert et al. 2009b
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Nematoda	Cucullanidae	*Cucullanus* spp. (two pecies/morphotypes)	intestine	Rückert 2006
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Nematoda	Cucullanidae	*Cucullanus* spp. (two pecies/morphotypes)	intestine	Rückert et al. 2009b
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Nematoda	nr	Nematoda indet.	intestine	Rückert 2006
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Nematoda	nr	Nematoda indet.	intestine	Rückert et al. 2009b
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	pyloric caeca	Rückert 2006

Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	pyloric caeca	Rückert et al. 2009b
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Nematoda	Rhadinorhynchidae	*Gorgorhynchus* sp.	intestine	Rückert 2006
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Nematoda	Rhadinorhynchidae	*Gorgorhynchus* sp.	intestine	Rückert et al. 2009b
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Nematoda	Rhadinorhynchidae	*Leptorhynchoides thecatus* (Linton, 1891) Kostylev, 1924	intestine	Rückert 2006
Perciformes	Gerreidae	*Pentaprion longimanus* (Cantor, 1849)	Nematoda	Rhadinorhynchidae	*Leptorhynchoides thecatus* (Linton, 1891) Kostylev, 1924	intestine	Rückert et al. 2009b
Perciformes	**Gobiidae**	***Acentrogobius nebulosus* (Forsskål, 1775)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Gobiidae**	***Acentrogobius nebulosus* (Forsskål, 1775)**	**Cestoda**	**Rhinebothriidae**	***Rhinebothrium* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Gobiidae**	***Acentrogobius nebulosus* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Bomolochidae**	**Bomolochidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Gobiidae**	***Acentrogobius nebulosus* (Forsskål, 1775)**	**Monogenea**	**Capsalidae**	**Capsalidae indet.**	**surface**	**Present study, workshop Bali**
Perciformes	**Gobiidae**	***Acentrogobius nebulosus* (Forsskål, 1775)**	**Nematoda**	**Camallanidae**	***Spirocamallanus* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Gobiidae**	***Acentrogobius nebulosus* (Forsskål, 1775)**	**Nematoda**	**Philometridae**	**Philometridae indet.**	**eye cavity**	**Present study, workshop Bali**
Perciformes	Gobiidae	*Bathygobius cyclopterus* (Valenciennes, 1837)	Crustacea: Copepoda	Pennellidae	*Haemobaphes dilectus* Leigh-Sharpe, 1934 *taxon inquirendum*	nr	Leigh-Sharpe 1934
Perciformes	Gobiidae	*Cryptocentrus leptocephalus* Bleeker, 1876	Digenea	Opecoelidae	*Plagioporus* sp.	stomach	Asnita 2011
Perciformes	Gobiidae	*Cryptocentrus leptocephalus* Bleeker, 1876	Digenea	Opecoelidae	*Podocotyle* sp.	stomach	Asnita 2011
Perciformes	Gobiidae	*Cryptocentrus leptocephalus* Bleeker, 1876	Monogenea	Ancyrocephalidae	*Pseudempleurosoma* sp. (cf. sp. nov.)	stomach	Asnita 2011
Perciformes	Gobiidae	*Cryptocentrus leptocephalus* Bleeker, 1876	Monogenea	Capsalidae	*Benedenia* sp.	gills	Asnita 2011
Perciformes	Gobiidae	*Cryptocentrus leptocephalus* Bleeker, 1876	Nematoda	Camallanidae	*Procamallanus* sp.	stomach	Asnita 2011
Perciformes	Gobiidae	*Cryptocentrus leptocephalus* Bleeker, 1876	Nematoda	Cucullanidae	*Cucullanus* sp.	stomach	Asnita 2011
Perciformes	Gobiidae	*Cryptocentrus leptocephalus* Bleeker, 1876	Nematoda	Gnathostomatidae	*Gnathostoma* sp.[34]	stomach	Asnita 2011
Perciformes	Gobiidae	*Gobius* sp.	Digenea	Opecoelidae	*Opegaster gobii* Yamaguti, 1952	intestine	Yamaguti 1952
Perciformes	Gobiidae	*Gobius* sp.	Digenea	Opecoelidae	*Opegaster longivesicula* Yamaguti, 1952	intestine	Yamaguti 1952
Perciformes	Haemulidae	*Diagramma* sp.	Cestoda	Amphilinidae	*Gigantolina magna* (Southwell, 1915) Poche, 1922	body cavity	Yamaguti 1954a
Perciformes	Haemulidae	*Diagramma* sp.	Digenea	Monorchiidae	*Monorchicestrahelmins lethrini* (Yamaguti, 1953)	pyloric caeca	Yamaguti 1953b
Perciformes	Haemulidae	*Diagramma* sp.	Digenea	Opecoelidae	*Podocotyloides gracilis* (Yamaguti, 1952) Pritchard, 1966	pyloric caeca	Yamaguti 1952
Perciformes	**Haemulidae**	***Plectorhinchus gibbosus* (Lacépède, 1802)**	**Cestoda**	**Eutetrarhynchidae**	***Parachristianella monomegacantha* Kruse, 1959**	**intestine**	**Present study, workshop Bali**
Perciformes	Haemulidae	*Plectorhinchus gibbosus* (Lacépède, 1802)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Muthmainnah 2004
Perciformes	Haemulidae	*Plectorhinchus gibbosus* (Lacépède, 1802)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Slade 2001
Perciformes	**Haemulidae**	***Plectorhinchus gibbosus* (Lacépède, 1802)**	**Crustacea: Copepoda**	**Caligidae**	***Anuretes* cf. *plectorhynchi* Yamaguti, 1936**	**gills**	**Present study, workshop Bali**
Perciformes	**Haemulidae**	***Plectorhinchus gibbosus* (Lacépède, 1802)**	**Digenea**	**Cryptogonimidae**	**Cryptogonimidae indet. spp. (two species/morphotypes)**	**stomach**	**Present study, workshop Bali**
Perciformes	**Haemulidae**	***Plectorhinchus schotaf* (Forsskål, 1775)**	**Digenea**	**Cryptogonimidae**	**Cryptogonimidae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Haemulidae**	***Plectorhinchus schotaf* (Forsskål, 1775)**	**Hirudinea**	**nr**	**Hirudinea indet.**	**gills**	**Present study, workshop Bali**
Perciformes	Haemulidae	*Plectorhinchus* sp.	Crustacea: Copepoda	Caligidae	*Anuretes plectorhynchi* Yamaguti, 1936	gills	Yamaguti 1954d
Perciformes	**Haemulidae**	***Pomadasys kaakan* (Cuvier, 1830)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**mesenteries**	**Present study**
Perciformes	**Haemulidae**	***Pomadasys kaakan* (Cuvier, 1830)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**mouth**	**Present study**
Perciformes	**Haemulidae**	***Pomadasys kaakan* (Cuvier, 1830)**	**Crustacea: Copepoda**	**Lernaeopodidae**	***Margolisius abditus* Benz, Kabata & Bullard, 2000**	**fins**	**Present study**
Perciformes	**Haemulidae**	***Pomadasys kaakan* (Cuvier, 1830)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus* cf. *kroyeri* Van Beneden, 1851**	**gills**	**Present study**
Perciformes	**Haemulidae**	***Pomadasys kaakan* (Cuvier, 1830)**	**Crustacea: Isopoda**	**Corallanidae**	**Corallanidae indet.**	**mouth**	**Present study**
Perciformes	**Haemulidae**	***Pomadasys kaakan* (Cuvier, 1830)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study**
Perciformes	**Haemulidae**	***Pomadasys kaakan* (Cuvier, 1830)**	**Digenea**	**Bivesiculidae**	***Treptodemoides* cf. *flukenensis* (Liu, 1995) Cribb, 2002**	**intestine**	**Present study**
Perciformes	**Haemulidae**	***Pomadasys kaakan* (Cuvier, 1830)**	**Digenea**	**Monorchiidae**	***Pseudametrodaptes* sp.**	**intestine**	**Present study**

Perciformes	**Haemulidae**	***Pomadasys kaakan* (Cuvier, 1830)**	**Digenea**	**nr**	**Digenea indet. spp. (four species/morphotypes)**	**intestine**	**Present study**
Perciformes	**Haemulidae**	***Pomadasys kaakan* (Cuvier, 1830)**	**Monogenea**	**Tetraonchidae**	**Tetraonchidae indet.**	**gills**	**Present study**
Perciformes	**Haemulidae**	***Pomadasys kaakan* (Cuvier, 1830)**	**Nematoda**	**Cucullanidae**	***Dichelyne* (*Cucullanellus*) sp.**	**intestine**	**Present study**
Perciformes	**Haemulidae**	***Pomadasys kaakan* (Cuvier, 1830)**	**Nematoda**	**nr**	**Nematoda indet.**	**intestine**	**Present study**
Perciformes	Haemulidae	*Pomadasys maculatus* (Bloch, 1793)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	mesenteries	Rahmawati 2013
Perciformes	**Haemulidae**	***Pomadasys maculatus* (Bloch, 1793)**	**Acanthocephala**	**Rhadinorhynchidae**	***Serrasentis sagittifer* (Linton, 1889)**	**mesenteries**	**Present study**
Perciformes	Haemulidae	*Pomadasys maculatus* (Bloch, 1793)	Crustacea: Copepoda	Caligidae	*Caligus* sp.	mouth	Rahmawati 2013
Perciformes	**Haemulidae**	***Pomadasys maculatus* (Bloch, 1793)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**mouth**	**Present study**
Perciformes	Haemulidae	*Pomadasys maculatus* (Bloch, 1793)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus* cf. *kroyeri* Van Beneden, 1851	gills	Rahmawati 2013
Perciformes	**Haemulidae**	***Pomadasys maculatus* (Bloch, 1793)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus* cf. *kroyeri* Van Beneden, 1851**	**gills**	**Present study**
Perciformes	Haemulidae	*Pomadasys maculatus* (Bloch, 1793)	Digenea	Hemiuridae	*Qadriana* cf. *fusiformis* Bilqees, 1971	stomach	Rahmawati 2013
Perciformes	**Haemulidae**	***Pomadasys maculatus* (Bloch, 1793)**	**Digenea**	**Hemiuridae**	***Qadriana* cf. *fusiformis* Bilqees, 1971**	**stomach**	**Present study**
Perciformes	Haemulidae	*Pomadasys maculatus* (Bloch, 1793)	Digenea	nr	Digenea indet. spp. (three species/morphotypes)	intestine	Rahmawati 2013
Perciformes	**Haemulidae**	***Pomadasys maculatus* (Bloch, 1793)**	**Digenea**	**nr**	**Digenea indet. spp. (three species/morphotypes)**	**intestine**	**Present study**
Perciformes	Haemulidae	*Pomadasys maculatus* (Bloch, 1793)	Monogenea	Calceostomatidae	Calceostomatidae indet.	gill cavity	Rahmawati 2013
Perciformes	**Haemulidae**	***Pomadasys maculatus* (Bloch, 1793)**	**Monogenea**	**Calceostomatidae**	**Calceostomatidae indet.**	**gill cavity**	**Present study**
Perciformes	Haemulidae	*Pomadasys maculatus* (Bloch, 1793)	Monogenea	Dactylogyridae	Dactylogyridae indet.	gills	Rahmawati 2013
Perciformes	**Haemulidae**	***Pomadasys maculatus* (Bloch, 1793)**	**Monogenea**	**Dactylogyridae**	**Dactylogyridae indet.**	**gills**	**Present study**
Perciformes	Haemulidae	*Pomadasys maculatus* (Bloch, 1793)	Monogenea	Microcotylidae	*Microcotyle* sp.	gills	Rahmawati 2013
Perciformes	**Haemulidae**	***Pomadasys maculatus* (Bloch, 1793)**	**Monogenea**	**Microcotylidae**	***Microcotyle* sp.**	**gills**	**Present study**
Perciformes	Haemulidae	*Pomadasys maculatus* (Bloch, 1793)	Nematoda	Anisakidae	*Anisakis* sp.[30]	intestine	Rahmawati 2013
Perciformes	Haemulidae	*Pomadasys maculatus* (Bloch, 1793)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	intestine	Palm & Theisen et al. 2017
Perciformes	Haemulidae	*Pomadasys maculatus* (Bloch, 1793)	Nematoda	Cucullanidae	*Cucullanus* sp.	intestine	Rahmawati 2013
Perciformes	**Haemulidae**	***Pomadasys maculatus* (Bloch, 1793)**	**Nematoda**	**Cucullanidae**	***Cucullanus* sp.**	**intestine**	**Present study**
Perciformes	Haemulidae	*Pomadasys maculatus* (Bloch, 1793)	Nematoda	Philometridae	*Philometra* sp.	body cavity	Rahmawati 2013
Perciformes	**Haemulidae**	***Pomadasys maculatus* (Bloch, 1793)**	**Nematoda**	**Philometridae**	***Philometra* sp.**	**body cavity**	**Present study**
Perciformes	Haemulidae	*Pomadasys maculatus* (Bloch, 1793)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	pyloric caeca	Rahmawati 2013
Perciformes	**Haemulidae**	***Pomadasys maculatus* (Bloch, 1793)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**pyloric caeca**	**Present study**
Perciformes	Istiophoridae	*Istiophorus platypterus* (Shaw, 1792)	Crustacea: Copepoda	Pennellidae	*Pennella* sp.	sklin to muscle	Loud 2012
Perciformes	**Labridae**	***Hologymnosus doliatus* (Lacepède, 1801)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**mesenteries**	**Present study, workshop Bali**
Perciformes	**Labridae**	***Hologymnosus doliatus* (Lacepède, 1801)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**intestine**	**Present study, workshop Bali**
Perciformes	Latidae	*Lates calcarifer* (Bloch, 1790)	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	stomach wall	Palm 2004
Perciformes	Latidae	*Lates calcarifer* (Bloch, 1790)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus latis* Yamaguti 1954	gills	Sarjito & Desrina 2005
Perciformes	Latidae	*Lates calcarifer* (Bloch, 1790)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus latis* Yamaguti 1954	gills	Yamaguti 1954d
Perciformes	Latidae	*Lates calcarifer* (Bloch, 1790)	Digenea	Cryptogonimidae	*Pseudometadena celebesensis* Yamaguti, 1952	pyloric caeca	Yamaguti 1952
Perciformes	Latidae	*Lates calcarifer* (Bloch, 1790)	Digenea	Opecoelidae	*Opecoelus piriformis* Yamaguti, 1952	pyloric caeca	Yamaguti 1952
Perciformes	Latidae	*Lates calcarifer* (Bloch, 1790)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Awik et al. 2007
Perciformes	Latidae	*Lates calcarifer* (Bloch, 1790)	Nematoda	Cucullanidae	*Cucullanus heterochrous* Rudolphi, 1802	nr	Sarjito & Desrina 2005
Perciformes	Latidae	*Lates calcarifer* (Bloch, 1790)	Nematoda	Cucullanidae	*Dichelyne exiguus* (Yamaguti, 1954)	pyloric caeca	Yamaguti 1954c
Perciformes	**Latidae**	***Psammoperca waigiensis* (Cuvier, 1828) (aquaculture)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**intestine**	**Present study, workshop Bali**

Perciformes	**Latidae**	***Psammoperca waigiensis* (Cuvier, 1828) (aquaculture)**	**Ciliophora: Mobilida**	**Trichodinidae**	***Trichodina* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	**Latidae**	***Psammoperca waigiensis* (Cuvier, 1828) (aquaculture)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus latis* Yamaguti 1954**	**gills**	**Present study, workshop Bali**
Perciformes	**Latidae**	***Psammoperca waigiensis* (Cuvier, 1828) (aquaculture)**	**Digenea**	**Aporocotylidae**	**Aporocotylidae indet.**	**heart**	**Present study, workshop Bali**
Perciformes	**Latidae**	***Psammoperca waigiensis* (Cuvier, 1828) (aquaculture)**	**Digenea**	**Cryptogonimidae**	**Cryptogonimidae indet. spp. (two species/morphotypes)**	**guts**	**Present study, workshop Bali**
Perciformes	**Latidae**	***Psammoperca waigiensis* (Cuvier, 1828) (aquaculture)**	**Monogenea**	**Capsalidae**	**Capsalidae indet.**	**surface**	**Present study, workshop Bali**
Perciformes	**Latidae**	***Psammoperca waigiensis* (Cuvier, 1828) (aquaculture)**	**Monogenea**	**Dactylogyridae**	**Dactylogyridae indet. spp. (two sepecies/morphotypes)**	**gills**	**Present study, workshop Bali**
Perciformes	**Latidae**	***Psammoperca waigiensis* (Cuvier, 1828) (aquaculture)**	**Monogenea**	**Diplectanidae**	**Diplectanidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Latidae**	***Psammoperca waigiensis* (Cuvier, 1828) (aquaculture)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	**Latidae**	***Psammoperca waigiensis* (Cuvier, 1828) (aquaculture)**	**Myxozoa: Myxosporea**	**Kudoidae**	***Kudoa* sp.**	**musculature**	**Present study, workshop Bali**
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Acanthocephala	nr	Acanthocephala indet.	mesenteries	Rückert 2006
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Acanthocephala	nr	Acanthocephala indet.	mesenteries	Rückert et al. 2009b
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Crustacea: Copepoda	Bomolochidae	Bomolochidae indet.	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Crustacea: Copepoda	Bomolochidae	Bomolochidae indet.	gills	Rückert 2006
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Crustacea: Copepoda	Bomolochidae	*Holobomolochus* sp.	gills	Rückert 2006
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Crustacea: Copepoda	Bomolochidae	*Holobomolochus* sp.	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus quadriceros* Pillai, 1973	gills	Rückert 2006
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus quadriceros* Pillai, 1973	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus gazzis* Song & Chen, 1976	gills	Rückert 2006
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus gazzis* Song & Chen, 1976	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus* sp.	gills	Rückert 2006
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus* sp.	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Digenea	Hemiuridae	*Ectenurus leiognathi* (Yamaguti, 1953)	stomach	Yamaguti 1953b
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Monogenea	Diplectanidae	*Calydiscoides scolopsidis* Lim, 2003	gills	Rückert 2006
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Monogenea	Diplectanidae	*Calydiscoides scolopsidis* Lim, 2003	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Monogenea	Microcotylidae	*Microcotyle* sp.	gills	Rückert 2006
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Monogenea	Microcotylidae	*Microcotyle* sp.	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Nematoda	Rhadinorhynchidae	*Leptorhynchoides thecatus* (Linton, 1891) Kostylev, 1924	intestine	Rückert 2006
Perciformes	Leiognathidae	*Equulites stercorarius* (Evermann & Seale, 1907)	Nematoda	Rhadinorhynchidae	*Leptorhynchoides thecatus* (Linton, 1891) Kostylev, 1924	intestine	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Acanthocephala	Quadrigyridae	*Pallisentis* sp.	intestine	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Acanthocephala	Quadrigyridae	*Pallisentis* sp.	intestine	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Crustacea: Copepoda	Bomolochidae	Bomolochidae indet.	gills	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Crustacea: Copepoda	Bomolochidae	Bomolochidae indet.	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Crustacea: Copepoda	Bomolochidae	*Holobomolochus* sp.	gills	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Crustacea: Copepoda	Bomolochidae	*Holobomolochus* sp.	gills	Rückert et al. 2009b

Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus quadriceros* Pillai, 1973	gills	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus quadriceros* Pillai, 1973	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Crustacea: Copepoda	Lernaeopodidae	*Proclavellodes pillai* Kabata, 1967	gills	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Crustacea: Copepoda	Lernaeopodidae	*Proclavellodes pillai* Kabata, 1967	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus gazzis* Song & Chen, 1976	gills	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus gazzis* Song & Chen, 1976	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Digenea	Hemiuridae	*Parahemiurus* sp.	stomach	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Digenea	Hemiuridae	*Parahemiurus* sp.	stomach	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Digenea	nr	Digenea indet.	intestine	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Digenea	nr	Digenea indet.	intestine	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Digenea	Opecoelidae	*Neochoanostoma* sp.	gills	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Digenea	Opecoelidae	*Neochoanostoma* sp.	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Monogenea	Diplectanidae	*Calydiscoides flexuosus* (Yamaguti, 1953) Young, 1969	gills	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Monogenea	Diplectanidae	*Calydiscoides flexuosus* (Yamaguti, 1953) Young, 1969	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Monogenea	Diplectanidae	*Calydiscoides scolopsidis* Lim, 2003	gills	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Monogenea	Diplectanidae	*Calydiscoides scolopsidis* Lim, 2003	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Monogenea	Microcotylidae	*Microcotyle* sp.	gills	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Monogenea	Microcotylidae	*Microcotyle* sp.	gills	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Nematoda	Cucullanidae	*Cucullanus* sp.	stomach	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Nematoda	Cucullanidae	*Cucullanus* sp.	stomach	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Nematoda	nr	Nematoda indet.	intestine	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Nematoda	nr	Nematoda indet.	intestine	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	mesenteries	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	mesenteries	Rückert et al. 2009b
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Nematoda	Raphidascarididae	*Raphidascaris* sp. (second morphotype from stomach-wall)	intestine	Rückert 2006
Perciformes	Leiognathidae	*Gazza minuta* (Bloch, 1795)	Nematoda	Raphidascarididae	*Raphidascaris* sp. (second morphotype from stomach-wall)	intestine	Rückert et al. 2009b
Perciformes	Leiognathidae	*Leiognathus dussumieri* (Valenciennes, 1835)	Digenea	Hemiuridae	*Ectenurus leiognathi* (Yamaguti, 1953)	stomach	Yamaguti 1953b
Perciformes	Leiognathidae	*Leiognathus dussumieri* (Valenciennes, 1835)	Nematoda	Anisakidae	*Anisakis* sp.[30]	pyloric caeca	Palm & Theisen et al. 2017
Perciformes	Leiognathidae	*Leiognathus dussumieri* (Valenciennes, 1835)	Nematoda	Anisakidae	*Anisakis* sp.[30]	pyloric caeca	Palm et al. 2008
Perciformes	Leiognathidae	*Leiognathus dussumieri* (Valenciennes, 1835)	Nematoda	Anisakidae	*Anisakis* sp.[30]	pyloric caeca	Yamaguti 1954c
Perciformes	**Leiognathidae**	***Photopectoralis bindus* (Valenciennes, 1835)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus* cf. *gazzis* Song & Chen, 1976**	**gills**	**Present study, workshop Bali**
Perciformes	**Lethrinidae**	***Lethrinus lentjan* (Lacepède, 1802)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Lethrinidae**	***Lethrinus lentjan* (Lacepède, 1802)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	Lethrinidae	*Lethrinus* sp.	Crustacea: Copepoda	Hatschekiidae	*Hatschekia gracilis* Yamaguti, 1954	gills	Yamaguti 1954d
Perciformes	Lethrinidae	*Lethrinus* sp.	Crustacea: Isopoda	Corallanidae	*Argathona macronema* (Bleeker, 1857)	surface	Bleeker 1857
Perciformes	Lethrinidae	*Lethrinus* sp.	Crustacea: Isopoda	Corallanidae	*Argathona macronema* (Bleeker, 1857)	surface	Delaney 1989
Perciformes	Lethrinidae	*Lethrinus* sp.	Crustacea: Isopoda	Corallanidae	*Argathona macronema* (Bleeker, 1857)	surface	Nierstrasz 1931
Perciformes	Lethrinidae	*Lethrinus* sp.	Crustacea: Isopoda	Corallanidae	*Argathona macronema* (Bleeker, 1857)	surface	Richardson 1910

Perciformes	Lethrinidae	*Lethrinus* sp.	Crustacea: Isopoda	Corallanidae	*Argathona macronema* (Bleeker, 1857)	surface	Sidabalok 2013
Perciformes	Lethrinidae	*Lethrinus* sp.	Digenea	Acanthocolpidae	*Pseudolepidapedon lethrini* Yamaguti, 1952	pyloric caeca	Yamaguti 1952
Perciformes	Lethrinidae	*Lethrinus* sp.	Digenea	Monorchiidae	*Monorchicestrahelmins lethrini* (Yamaguti, 1953)	pyloric caeca	Yamaguti 1953b
Perciformes	Lethrinidae	*Lethrinus* sp.	Digenea	Opecoelidae	*Hamacreadium mutabile* Linton, 1910	pyloric caeca	Yamaguti 1952
Perciformes	Lethrinidae	*Lethrinus* sp.	Digenea	Opecoelidae	*Macvicaria macassarensis* (Yamaguti, 1952) Bray & Cribb, 1989	pyloric caeca	Yamaguti 1952
Perciformes	Lethrinidae	*Lethrinus* sp.	Digenea	Opecoelidae	*Podocotyloides gracilis* (Yamaguti, 1952) Pritchard, 1966	pyloric caeca	Yamaguti 1952
Perciformes	Lethrinidae	*Lethrinus* sp.	Monogenea	Diplectanidae	*Calydiscoides difficilis* (Yamaguti, 1953) Young, 1969	gills	Yamaguti 1953a
Perciformes	Lethrinidae	*Lethrinus* sp.	Monogenea	Diplectanidae	*Calydiscoides duplicostatus* (Yamaguti, 1953) Young, 1969	gills	Yamaguti 1953a
Perciformes	Lethrinidae	*Lethrinus* sp.	Nematoda	Ascarididae	Ascarididae indet. (as *Porrocaecum* sp.)	body cavity	Yamaguti 1954c
Perciformes	Lobotidae	*Lobotes surinamensis* (Bloch, 1790)	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	musculature	Palm 2004
Perciformes	Lobotidae	*Lobotes surinamensis* (Bloch, 1790)	Crustacea: Copepoda	Caligidae	*Caligus macrurus* Heller, 1865	nr	Heller 1865
Perciformes	Lobotidae	*Lobotes surinamensis* (Bloch, 1790)	Crustacea: Copepoda	Caligidae	*Caligus tenax* Heller, 1865	nr	Bassett-Smith 1899
Perciformes	Lobotidae	*Lobotes surinamensis* (Bloch, 1790)	Digenea	Lecithasteridae	*Hysterolecitha nahaensis* Yamaguti, 1942	intestine	Yamaguti 1953b
Perciformes	Lobotidae	*Lobotes surinamensis* (Bloch, 1790)	Digenea	Lecithasteridae	*Lecithaster stellatus* Looss, 1907		Yamaguti 1953b
Perciformes	**Lobotidae**	***Lobotes surinamensis* (Bloch, 1790)**	**Monogenea**	**Capsalidae**	**Capsalidae indet.**	**surface**	**Present study, workshop Bali**
Perciformes	Lobotidae	*Lobotes surinamensis* (Bloch, 1790)	Nematoda	Philometridae	*Philometra lobotidis* Moravec, Walter & Yuniar, 2012	body cavity	Dewi & Palm 2017, workshop
Perciformes	Lobotidae	*Lobotes surinamensis* (Bloch, 1790)	Nematoda	Philometridae	*Philometra lobotidis* Moravec, Walter & Yuniar, 2012	body cavity	Moravec et al. 2012
Perciformes	**Lutjanidae**	***Lutjanus argentimaculatus* (Forsskål, 1775)**	**Acanthocephala**	**Pomphorhynchidae**	***Pomphorhynchus* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus argentimaculatus* (Forsskål, 1775)**	**Acanthocephala**	**Rhadinorhynchidae**	***Serrasentis sagittifer* (Linton, 1889)**	**intestine**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus argentimaculatus* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Hatschekiidae**	***Hatschekia* spp. (two species/morphotypes)**	**gills**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus argentimaculatus* (Forsskål, 1775)**	**Digenea**	**Cryptogonimidae**	**Cryptogonimidae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus argentimaculatus* (Forsskål, 1775)**	**Monogenea**	**Capsalidae**	**Capsalidae indet.**	**surface**	**Present study, workshop Bali**
Perciformes	Lutjanidae	*Lutjanus argentimaculatus* (Forsskål, 1775)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017, workshop
Perciformes	**Lutjanidae**	***Lutjanus argentimaculatus* (Forsskål, 1775)**	**Nematoda**	**Anisakidae**	**cf. *Terranova* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus argentimaculatus* (Forsskål, 1775)**	**Nematoda**	**Gnathostomatidae**	***Echinocephalus* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus argentimaculatus* (Forsskål, 1775)**	**Nematoda**	**nr**	**Nematoda indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus bohar* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Hatschekiidae**	***Hatschekia* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus carponotatus* (Richardson, 1842)**	**Acanthocephala**	**Rhadinorhynchidae**	***Serrasentis sagittifer* (Linton, 1889)**	**intestine**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus carponotatus* (Richardson, 1842)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**body wash**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus carponotatus* (Richardson, 1842)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus carponotatus* (Richardson, 1842)**	**Digenea**	**Hemiuridae**	**Hemiuridae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus carponotatus* (Richardson, 1842)**	**Monogenea**	**Capsalidae**	**Capsalidae indet.**	**surface**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus carponotatus* (Richardson, 1842)**	**Nematoda**	**Raphidascarididae**	***Raphidascaris* cf. *(Ichthyascaris) lutjani* Olsen, 1952**	**guts**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus ehrenbergii* (Peters, 1869)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**body wash**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus ehrenbergii* (Peters, 1869)**	**Crustacea: Isopoda**	**Cymothoidae**	***Cymothoa* sp.**	**mouth**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus ehrenbergii* (Peters, 1869)**	**Digenea**	**Hemiuridae**	***Erilepturus* cf. *lutianius* (Gu & Shen, 1978)**	**stomach**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus ehrenbergii* (Peters, 1869)**	**Digenea**	**Hemiuridae**	**Hemiuridae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus ehrenbergii* (Peters, 1869)**	**Monogenea**	**Capsalidae**	**Capsalidae indet.**	**surface**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus ehrenbergii* (Peters, 1869)**	**Monogenea**	**Dactylogyridae**	**Dactylogyridae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus ehrenbergii* (Peters, 1869)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**mesenteries**	**Present study, workshop Bali**

Perciformes	**Lutjanidae**	***Lutjanus fulviflamma* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Hatschekiidae**	***Hatschekia* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus fulviflamma* (Forsskål, 1775)**	**Digenea**	**Cryptogonimidae**	***Euryakaina* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus fulviflamma* (Forsskål, 1775)**	**Digenea**	**Cryptogonimidae**	***Siphoderina* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus fulviflamma* (Forsskål, 1775)**	**Monogenea**	**Capsalidae**	**Capsalidae indet.**	**surface**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus fulviflamma* (Forsskål, 1775)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**mesenteries**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus fulvus* (Forster, 1801)**	**Crustacea: Copepoda**	**Bomolochidae**	**Bomolochidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus fulvus* (Forster, 1801)**	**Crustacea: Isopoda**	**Cymothoidae**	***Cymothoa* sp.**	**mouth**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus fulvus* (Forster, 1801)**	**Nematoda**	**Cucullanidae**	***Cucullanus* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus gibbus* (Forsskål, 1775)**	**Nematoda**	**Cucullanidae**	***Cucullanus* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	Lutjanidae	*Lutjanus johnii* (Bloch, 1792)	Hirudinea	Piscicolidae	*Zeylanicobdella arugamensis* De Silva, 1963	surface	Rückert et al. 2009a
Perciformes	Lutjanidae	*Lutjanus johnii* (Bloch, 1792)	Hirudinea	Piscicolidae	*Zeylanicobdella arugamensis* De Silva, 1963	surface	Yuniar 2005
Perciformes	Lutjanidae	*Lutjanus kasmira* (Forsskål, 1775)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Ilahude 1980
Perciformes	Lutjanidae	*Lutjanus kasmira* (Forsskål, 1775)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm et al. 2008
Perciformes	**Lutjanidae**	***Lutjanus malabaricus* (Bloch & Schneider, 1801)**	**Cestoda**	**Lacistorhynchidae**	***Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931**	**intestine**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus malabaricus* (Bloch & Schneider, 1801)**	**Crustacea: Copepoda**	**Hatschekiidae**	***Hatschekia* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus malabaricus* (Bloch & Schneider, 1801)**	**Digenea**	**Cryptogonimidae**	**Cryptogonimidae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	Lutjanidae	*Lutjanus malabaricus* (Bloch & Schneider, 1801)	Nematoda	Anisakidae	*Anisakis* cf. *typica* var. *indonesiensis* Palm & Theisen et al. 2018	body cavity	Palm & Theisen et al. 2017
Perciformes	Lutjanidae	*Lutjanus malabaricus* (Bloch & Schneider, 1801)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Muttaqin & Abdulgani 2013
Perciformes	Lutjanidae	*Lutjanus malabaricus* (Bloch & Schneider, 1801)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Setyobudi et al. 2011
Perciformes	**Lutjanidae**	***Lutjanus malabaricus* (Bloch & Schneider, 1801)**	**Nematoda**	**Anisakidae**	***Terranova* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus rivulatus* (Cuvier, 1828)**	**Crustacea: Copepoda**	**Hatschekiidae**	***Hatschekia* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus rivulatus* (Cuvier, 1828)**	**Digenea**	**Cryptogonimidae**	**Cryptogonimidae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus rivulatus* (Cuvier, 1828)**	**Digenea**	**Cryptogonimidae**	***Euryakaina manilensis* (Velasquez, 1961) Miller et al. 2010**	**intestine**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus rivulatus* (Cuvier, 1828)**	**Digenea**	**Cryptogonimidae**	***Lobosorchis* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus rivulatus* (Cuvier, 1828)**	**Monogenea**	**Capsalidae**	**Capsalidae indet.**	**surface**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus russellii* (Bleeker, 1849)**	**Cestoda**	**Lacistorhynchidae**	***Callitetrarhynchus* cf. *gracilis* (Rudolphi, 1819) Pintner, 1931**	**intestine**	**Present study, workshop Bali**
Perciformes	Lutjanidae	*Lutjanus sanguineus* (Cuvier, 1828)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia balistae* Nuñes-Ruivo, 1954	gills	Tiku 2001
Perciformes	Lutjanidae	*Lutjanus sanguineus* (Cuvier, 1828)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia conifera* Yamaguti, 1939	gills	Tiku 2001
Perciformes	Lutjanidae	*Lutjanus sanguineus* (Cuvier, 1828)	Digenea	Sclerodistomidae	*Euryxenum sluiteri* Brock, 1886 *teram inquirendum*	stomach	Brock 1886
Perciformes	Lutjanidae	*Lutjanus sanguineus* (Cuvier, 1828)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Anggraeni 2014
Perciformes	Lutjanidae	*Lutjanus sebae* (Cuvier, 1816)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia* sp.	gills	Sirikan 1981
Perciformes	Lutjanidae	*Lutjanus* spp.	Digenea	Cryptogonimidae	*Siphoderina acanthostomus* (Yamaguti, 1934) Miller & Cribb, 2008	pyloric caeca	Yamaguti 1953b
Perciformes	Lutjanidae	*Lutjanus* spp.	Monogenea	Ancyrocephalidae	*Euryhaliotrema lutiani* (Yamaguti, 1953) Kritsky & Boeger, 2002	pyloric caeca	Yamaguti 1953a
Perciformes	Lutjanidae	*Lutjanus* spp.	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Batara 2008
Perciformes	Lutjanidae	*Lutjanus* spp.	Nematoda	Ascarididae	Ascarididae indet. (as *Porrocaecum* sp.)	body cavity	Yamaguti 1954c
Perciformes	Lutjanidae	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Crustacea: Copepoda	Caligidae	*Caligus* sp.	gill cavity	Zainurrahman 2013
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**gill cavity**	**Present study**
Perciformes	Lutjanidae	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Crustacea: Copepoda	Ergasilidae	Ergasilidae indet.	gill cavity	Zainurrahman 2013
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Crustacea: Copepoda**	**Ergasilidae**	**Ergasilidae indet.**	**gill cavity**	**Present study**

Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Crustacea: Copepoda**	**Hatschekiidae**	***Hatschekia* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	Lutjanidae	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Crustacea: Copepoda	Lernaeopodidae	*Parabrachiella lutiani* (Pillai, 1985)	gills	Zainurrahman 2013
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Crustacea: Copepoda**	**Lernaeopodidae**	***Parabrachiella lutiani* (Pillai, 1985)**	**gills**	**Present study**
Perciformes	Lutjanidae	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus lativentris* Heller, 1865	gills	Heller 1865
Perciformes	Lutjanidae	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Crustacea: Copepoda	Lernanthropidae	*Sagum* sp.	gills	Zainurrahman 2013
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Sagum* sp.**	**gills**	**Present study**
Perciformes	Lutjanidae	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Zainurrahman 2013
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study**
Perciformes	Lutjanidae	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Digenea	Cryptogonimidae	Digenea indet.[6]	intestine	Zainurrahman 2013
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Digenea**	**Cryptogonimidae**	***Euryakaina manilensis* (Velasquez, 1961) Miller et al. 2010**	**intestine**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Digenea**	**Hemiuridae**	**Hemiuridae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	Lutjanidae	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Digenea	Opecoelidae	*Hamacreadium* sp.	body soak	Zainurrahman 2013
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Digenea**	**Opecoelidae**	***Hamacreadium* sp.**	**body soak**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Digenea**	**Opecoelidae**	***Helicometra* cf. *fasciata* (Rudolphi, 1819) Odhner, 1902**	**intestine**	**Present study, workshop Bali**
Perciformes	Lutjanidae	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Digenea	Opecoelidae	*Helicometra* sp.[19]	intestine	Zainurrahman 2013
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Monogenea**	**Capsalidae**	**Capsalidae indet.**	**surface**	**Present study, workshop Bali**
Perciformes	Lutjanidae	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Nematoda**	**Camallanidae**	***Camallanus* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Nematoda**	**Cucullanidae**	***Cucullanus* sp.**	**guts**	**Present study**
Perciformes	Lutjanidae	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Nematoda	Cucullanidae	*Cucullanus* sp.[32]	guts	Zainurrahman 2013
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Nematoda**	**nr**	**Nematoda indet.**	**guts**	**Present study, workshop Bali**
Perciformes	Lutjanidae	*Lutjanus vitta* (Quoy & Gaimard, 1824)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	mesenteries	Zainurrahman 2013
Perciformes	**Lutjanidae**	***Lutjanus vitta* (Quoy & Gaimard, 1824)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**mesenteries**	**Present study**
Perciformes	Lutjanidae	*Pinjalo lewisi* Randall, Allen & Anderson, 1987	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Koinari et al. 2013
Perciformes	Lutjanidae	*Pinjalo lewisi* Randall, Allen & Anderson, 1987	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017
Perciformes	**Lutjanidae**	***Pinjalo pinjalo* (Bleeker, 1850)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Lutjanidae**	***Pinjalo pinjalo* (Bleeker, 1850)**	**Digenea**	**Lepocreadiidae**	***Preptetos* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	Lutjanidae	*Pinjalo pinjalo* (Bleeker, 1850)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Koinari et al. 2013
Perciformes	Lutjanidae	*Pinjalo pinjalo* (Bleeker, 1850)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017
Perciformes	**Lutjanidae**	***Pinjalo pinjalo* (Bleeker, 1850)**	**Nematoda**	**nr**	**Nematoda indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Malacanthidae**	***Malacanthus* cf. *brevirostris* Guichenot, 1848**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Malacanthidae**	***Malacanthus* cf. *brevirostris* Guichenot, 1848**	**Digenea**	**Opecoelidae**	**Opecoelidae indet. spp. (two species/morphotypes)**	**intestine**	**Present study, workshop Bali**
Perciformes	**Menidae**	***Mene maculata* (Bloch & Schneider, 1801)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropinus sphyraenae* (Yamaguti & Yamasu, 1959)**	**gills**	**Present study, workshop Bali**
Perciformes	Monodactylidae	*Monodactylus argenteus* (L.)	Crustacea: Iopoda	Cymothoidae	*Anilocra dimidiata* Bleeker, 1857	surface	Bruce 1987c
Perciformes	Monodactylidae	*Monodactylus argenteus* (L.)	Crustacea: Iopoda	Cymothoidae	*Anilocra dimidiata* Bleeker, 1857	nr	Nierstrasz 1915
Perciformes	Monodactylidae	*Monodactylus argenteus* (L.)	Crustacea: Iopoda	Cymothoidae	*Anilocra dimidiata* Bleeker, 1857	nr	Nierstrasz 1931
Perciformes	Monodactylidae	*Monodactylus argenteus* (L.)	Crustacea: Iopoda	Cymothoidae	*Anilocra dimidiata* Bleeker, 1857	nr	Sidabalok 2013
Perciformes	Monodactylidae	*Monodactylus argenteus* (L.)	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Bruce 1988
Perciformes	Monodactylidae	*Monodactylus argenteus* (L.)	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Nierstrasz 1915
Perciformes	Monodactylidae	*Monodactylus argenteus* (L.)	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Sachlan 1955

Perciformes	**Monodactylidae**	***Monodactylus argenteus* (L.)**	**Digenea**	**Hemiuridae**	***Lecithochirium* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	**Monodactylidae**	***Monodactylus argenteus* (L.)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	**Monodactylidae**	***Monodactylus argenteus* (L.)**	**Myxozoa: Myxosporea**	**Myxidiidae**	***Myxidium* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	**Mugilidae**	***Crenimugil buchanani* (Bleeker, 1853)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus platytarsis* Bassett-Smith, 1898**	**rear operculum**	**Present study, workshop Bali**
Perciformes	**Mugilidae**	***Crenimugil buchanani* (Bleeker, 1853)**	**Digenea**	**Haploporidae**	**Haploporidae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Mugilidae**	***Crenimugil buchanani* (Bleeker, 1853)**	**Myxozoa: Myxosporea**	**Myxobolidae**	***Myxobolus* sp.**	**musculature**	**Present study, workshop Bali**
Perciformes	Mugilidae	*Crenimugil crenilabis* (Forsskål, 1775)	Crustacea: Copepoda	Lernaeopodidae	*Thysanote* sp.	pectoral region	Leigh-Sharpe 1930
Perciformes	Mugilidae	*Mugil cephalus* L.	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp. (two species)	surface	Palm & Rückert 2009
Perciformes	Mugilidae	*Mugil cephalus* L.	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp. (two species)	surface	Yuniar 2005
Perciformes	Mugilidae	*Mugil cephalus* L.	Crustacea: Copepoda	Bomolochidae	*(Notho-?)Bomolochus* sp.	gills	Mulyanti 2001
Perciformes	Mugilidae	*Mugil cephalus* L.	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus* sp.	gills	Yuniar 2005
Perciformes	Mugilidae	*Mugil cephalus* L.	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus* sp.	gills	Yuniar et al. 2007
Perciformes	Mugilidae	*Mugil cephalus* L.	Crustacea: Copepoda	Caligidae	*Caligus* cf. *rotundigenitalis* Yü, 1933	inner operculum	Mulyanti 2001
Perciformes	Mugilidae	*Mugil cephalus* L.	Crustacea: Copepoda	Caligidae	*Caligus rotundigenitalis* Yü, 1933	inner operculum	Yuniar 2005
Perciformes	Mugilidae	*Mugil cephalus* L.	Crustacea: Copepoda	Caligidae	*Caligus rotundigenitalis* Yü, 1933	inner operculum	Yuniar et al. 2007
Perciformes	Mugilidae	*Mugil cephalus* L.	Crustacea: Copepoda	Ergasilidae	Ergasilidae indet.	gill cavity	Yuniar 2005
Perciformes	Mugilidae	*Mugil cephalus* L.	Crustacea: Copepoda	Ergasilidae	Ergasilidae indet.	gill cavity	Yuniar et al. 2007
Perciformes	Mugilidae	*Mugil cephalus* L.	Crustacea: Copepoda	Ergasilidae	*Ergasilus* spp. (two species/morphotypes)	gill cavity	Yuniar 2005
Perciformes	Mugilidae	*Mugil cephalus* L.	Crustacea: Copepoda	Ergasilidae	*Ergasilus* spp. (two species/morphotypes)	gill cavity	Yuniar et al. 2007
Perciformes	Mugilidae	*Mugil cephalus* L.	Digenea	Haploporidae	Haploporidae indet.[10]	intestine	Palm & Rückert 2009
Perciformes	Mugilidae	*Mugil cephalus* L.	Digenea	Haploporidae	Haploporidae indet.[10]	intestine	Yuniar 2005
Perciformes	Mugilidae	*Mugil cephalus* L.	Digenea	Haploporidae	*Haploporus magnisaccus* Machida, 1996	intestine	Machida 1996
Perciformes	Mugilidae	*Mugil cephalus* L.	Digenea	Haploporidae	*Lecithobotrys* sp.[11]	intestine	Yuniar 2005
Perciformes	Mugilidae	*Mugil cephalus* L.	Digenea	Haploporidae	*Pseudolecithobotrys stomachicola* (Machida, 1996) Blasco-Costa et al., 2009	gastric cardia	Machida 1996
Perciformes	Mugilidae	*Mugil cephalus* L.	Digenea	Haploporidae	*Pseudolecithobotrys stomachicola* (Machida, 1996) Blasco-Costa et al., 2009	intestine	Palm & Rückert 2009
Perciformes	Mugilidae	*Mugil cephalus* L.	Digenea	Lecithasteridae	*Hysterolecitha indonesiana* Machida, 1996	stomach	Machida 1996
Perciformes	Mugilidae	*Mugil cephalus* L.	Hirudinea	Piscicolidae	*Zeylanicobdella arugamensis* De Silva, 1963	surface	Rückert et al. 2009a
Perciformes	Mugilidae	*Mugil cephalus* L.	Hirudinea	Piscicolidae	*Zeylanicobdella arugamensis* De Silva, 1963	surface	Yuniar 2005
Perciformes	Mugilidae	*Mugil cephalus* L.	Monogenea	Axinidae	*(Meta?)microcotyla* sp.	gills	Mulyanti 2001
Perciformes	Mugilidae	*Mugil cephalus* L.	Monogenea	Axinidae	*Axine (Lintaxine?)* sp. (= 219?)	gills	Mulyanti 2001
Perciformes	Mugilidae	*Mugil cephalus* L.	Monogenea	Dactylogyridae	Dactylogyridae indet.	gills	Palm & Rückert 2009
Perciformes	Mugilidae	*Mugil cephalus* L.	Monogenea	Dactylogyridae	Dactylogyridae indet.	gills	Yuniar 2005
Perciformes	Mugilidae	*Mugil cephalus* L.	Monogenea	Microcotylidae	*Metamicrocotyla bora* Yamaguti, 1953	gills	Yamaguti 1953a
Perciformes	Mugilidae	*Mugil cephalus* L.	Monogenea	Microcotylidae	*Metamicrocotyla filiformis* Yamaguti, 1953	gills	Yamaguti 1953a
Perciformes	Mugilidae	*Mugil cephalus* L.	Monogenea	Microcotylidae	*Metamicrocotyla* sp.	gills	Palm & Rückert 2009
Perciformes	Mugilidae	*Mugil cephalus* L.	Monogenea	Microcotylidae	*Metamicrocotyla* sp.	gills	Yuniar 2005
Perciformes	Mugilidae	*Mugil cephalus* L.	Nematoda	nr	Nematoda indet.	stomach	Palm & Rückert 2009
Perciformes	Mugilidae	*Mugil cephalus* L.	Nematoda	nr	Nematoda indet.	stomach	Yuniar 2005
Perciformes	Mullidae	Mullidae indet.	Monogenea	Ancyrocephalidae	*Haliotrema alatum* Yamaguti, 1942	gills	Yamaguti 1953a

Perciformes	Mullidae	*Parupeneus barberinus* (Lacépède, 1801)	Crustacea: Isopoda	Cymothoidae	*Elthusa emarginata* (Bleeker, 1857)	inner operculum	Trilles 1976
Perciformes	Mullidae	*Parupeneus indicus* (Shaw, 1803)	Crustacea: Isopoda	Cymothoidae	*Elthusa emarginata* (Bleeker, 1857)	inner operculum	Haller 1880
Perciformes	Mullidae	*Parupeneus indicus* (Shaw, 1803)	Crustacea: Isopoda	Cymothoidae	*Elthusa emarginata* (Bleeker, 1857)	inner operculum	Nierstrasz 1931
Perciformes	Mullidae	*Parupeneus indicus* (Shaw, 1803)	Crustacea: Isopoda	Cymothoidae	*Elthusa emarginata* (Bleeker, 1857)	inner operculum	Sidabalok 2013
Perciformes	Mullidae	*Parupeneus indicus* (Shaw, 1803)	Crustacea: Isopoda	Cymothoidae	*Elthusa emarginata* (Bleeker, 1857)	inner operculum	Schiødte & Meinert 1879-1884
Perciformes	Mullidae	*Parupeneus* sp.	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Setyobudi et al. 2011
Perciformes	**Mullidae**	***Parupeneus spilurus* (Bleeker, 1854)**	**Crustacea: Copepoda**	**Hatschekiidae**	***Hatschekia* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	**Mullidae**	***Parupeneus spilurus* (Bleeker, 1854)**	**Digenea**	**Bucephalidae**	**Bucephalidae indet.**	**body cavity**	**Present study, workshop Bali**
Perciformes	**Mullidae**	***Parupeneus spilurus* (Bleeker, 1854)**	**Monogenea**	**Dactylogyridae**	**Dactylogyridae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	Mullidae	*Upeneus japonicus* (Houttuyn, 1782)	Crustacea: Copepoda	Taeniacanthidae	*Irodes upenei* (Yamaguti, 1954)	gills	Yamaguti 1954d
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	intestine	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	intestine	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	(Pseudophyllidea)	Pseudophyllidea indet. (larva)	intestine	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	(Pseudophyllidea)	Pseudophyllidea indet. (larva)	intestine	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	nr	Cestoda indet.	nr	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	nr	Cestoda indet.	nr	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	Otobothriidae	*Symbothriorhynchus tigaminacanthus* Palm, 2004	intestine	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	Otobothriidae	*Symbothriorhynchus tigaminacanthus* Palm, 2004	intestine	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	Tentaculariidae	*Heteronybelinia minima* Palm, 1999	musculature	Palm 2004
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	Tentaculariidae	*Heteronybelinia minima* Palm, 1999	musculature	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	Tentaculariidae	*Heteronybelinia minima* Palm, 1999	musculature	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	Tentaculariidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	musculature	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	Tentaculariidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	musculature	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	Tentaculariidae	*Nybelinia goreensis* Dollfuss, 1960	musculature	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	Tentaculariidae	*Nybelinia goreensis* Dollfuss, 1960	musculature	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	stomach	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	stomach	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus gazzis* Song & Chen, 1976	gills	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus gazzis* Song & Chen, 1976	gills	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus* sp.	gills	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus* sp.	gills	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus longicervis* (Pillai, 1963)	gills	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus longicervis* (Pillai, 1963)	gills	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Digenea	Didymozoidae	Didymozoidae indet.	body cavity	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Digenea	Didymozoidae	Didymozoidae indet.	body cavity	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Monogenea	Diclidophoridae	*Allotagia otolithis* (Yamaguti, 1953) Dillon & Hargis, 1965	gills	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Monogenea	Diclidophoridae	*Allotagia otolithis* (Yamaguti, 1953) Dillon & Hargis, 1965	gills	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Nematoda	Anisakidae	*Terranova* sp.	intestine	Rückert 2006

Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Nematoda	Anisakidae	*Terranova* sp.	intestine	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Nematoda	nr	Nematoda indet.	pyloric caeca	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Nematoda	nr	Nematoda indet.	pyloric caeca	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Nematoda	Raphidascarididae	*Hysterothylacium* spp. (two species/morphotypes)	pyloric caeca	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Nematoda	Raphidascarididae	*Hysterothylacium* spp. (two species/morphotypes)	pyloric caeca	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	intestine	Rückert 2006
Perciformes	Mullidae	*Upeneus moluccensis* (Bleeker, 1855)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	intestine	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus* sp.	Crustacea: Copepoda	Bomolochidae	*Bomolochus* sp.	gills	Sirikan 1981
Perciformes	Mullidae	*Upeneus* sp.	Crustacea: Copepoda	Taeniacanthidae	*Irodes upenei* (Yamaguti, 1954)	gills	Yamaguti 1954d
Perciformes	Mullidae	*Upeneus* sp.	Monogenea	Ancyrocephalidae	*Haliotrema upenei* Yamaguti, 1953	gills	Yamaguti 1953a
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	mesenteries	Rückert 2006
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	mesenteries	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Rückert 2006
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Cestoda	Tentacularidae	*Heteronybelinia minima* Palm, 1999	musculature	Palm 2004
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Cestoda	Tentacularidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	musculature	Palm 2004
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Cestoda	Tentacularidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	musculature	Rückert 2006
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Cestoda	Tentacularidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	musculature	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Cestoda	Tentacularidae	*Nybelinia indica* Chandra, 1986	musculature	Palm 2004
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Cestoda	Tentacularidae	*Nybelinia indica* Chandra, 1986	musculature	Rückert 2006
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Cestoda	Tentacularidae	*Nybelinia indica* Chandra, 1986	musculature	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Crustacea: Copepoda	Caligidae	*Caligus* sp.	gill cavity	Rückert 2006
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Crustacea: Copepoda	Caligidae	*Caligus* sp.	gill cavity	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus longicervis* (Pillai, 1963)	gills	Rückert 2006
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus longicervis* (Pillai, 1963)	gills	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Digenea	Didymozoidae	Didymozoidae indet.	body cavity	Rückert 2006
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Digenea	Didymozoidae	Didymozoidae indet.	body cavity	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Monogenea	Diclidophoridae	*Allotagia otolithis* (Yamaguti, 1953) Dillon & Hargis, 1965	gills	Rückert 2006
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Monogenea	Diclidophoridae	*Allotagia otolithis* (Yamaguti, 1953) Dillon & Hargis, 1965	gills	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Rückert 2006
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Nematoda	nr	Nematoda indet.	gonads	Rückert 2006
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Nematoda	nr	Nematoda indet.	gonads	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Nematoda	Raphidascarididae	*Hysterothylacium* spp. (two species/morphotypes)	pyloric caeca	Rückert 2006
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Nematoda	Raphidascarididae	*Hysterothylacium* spp. (two species/morphotypes)	pyloric caeca	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Nematoda	Raphidascarididae	*Raphidascaris* sp.	intestine	Rückert 2006
Perciformes	Mullidae	*Upeneus sulphureus* Cuvier, 1829	Nematoda	Raphidascarididae	*Raphidascaris* sp.	intestine	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus taeniopterus* Cuvier, 1829	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Tobing 2000
Perciformes	Mullidae	*Upeneus taeniopterus* Cuvier, 1829	Cestoda	Lacistorhynchidae	*Grillotia* sp.	intestine	Tobing 2000
Perciformes	Mullidae	*Upeneus taeniopterus* Cuvier, 1829	Crustacea: Copepoda	Bomolochidae	*Bomolochus* sp.	gills	Tobing 2000

Perciformes	Mullidae	*Upeneus taeniopterus* Cuvier, 1829	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus* cf. *gazzis* Song & Chen, 1976	gills	Tobing 2000
Perciformes	Mullidae	*Upeneus taeniopterus* Cuvier, 1829	Crustacea: Copepoda	Taeniacanthidae	*Irodes upenei* (Yamaguti, 1954) (as *Anchistrotos* sp.)	gills	Tobing 2000
Perciformes	Mullidae	*Upeneus taeniopterus* Cuvier, 1829	Digenea	Didymozoidae	Didymozoidae indet.	intestine	Tobing 2000
Perciformes	Mullidae	*Upeneus taeniopterus* Cuvier, 1829	Digenea	Lecithasteridae	*Aponurus* sp.	intestine	Tobing 2000
Perciformes	Mullidae	*Upeneus taeniopterus* Cuvier, 1829	Digenea	nr	Digenea indet. (as *Alloglossidium* sp.)	pyloric caeca	Tobing 2000
Perciformes	Mullidae	*Upeneus taeniopterus* Cuvier, 1829	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Tobing 2000
Perciformes	Mullidae	*Upeneus taeniopterus* Cuvier, 1829	Nematoda	Ascarididae	Ascarididae indet. (as *Porrocaecum* sp.)	body cavity	Tobing 2000
Perciformes	**Mullidae**	***Upeneus tragula* Richardson, 1846**	**Crustacea: Copepoda**	**Taeniacanthidae**	**cf. *Taeniacanthus longicervis* (Pillai, 1963)**	**gills**	**Present study, workshop Bali**
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Cestoda	Tentacularidae	*Heteronybelinia minima* Palm, 1999	musculature	Palm 2004
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Cestoda	Tentacularidae	*Heteronybelinia minima* Palm, 1999	musculature	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Cestoda	Tentacularidae	*Heteronybelinia minima* Palm, 1999	musculature	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Cestoda	Tentacularidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	body cavity	Palm 2004
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Cestoda	Tentacularidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	body cavity	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Cestoda	Tentacularidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	body cavity	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Cestoda	Tentacularidae	*Nybelinia goreensis* Dollfuss, 1960	musculature	Palm 2004
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Cestoda	Tentacularidae	*Nybelinia goreensis* Dollfuss, 1960	musculature	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Cestoda	Tentacularidae	*Nybelinia goreensis* Dollfuss, 1960	musculature	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Cestoda	Tentacularidae	*Nybelinia indica* Chandra, 1986	musculature	Palm 2004
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Cestoda	Tentacularidae	*Nybelinia indica* Chandra, 1986	stomach	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Cestoda	Tentacularidae	*Nybelinia indica* Chandra, 1986	stomach	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Crustacea: Copepoda	Caligidae	*Caligus* sp.	gill cavity	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Crustacea: Copepoda	Caligidae	*Caligus* sp.	gill cavity	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus longicervis* (Pillai, 1963)	gills	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus longicervis* (Pillai, 1963)	gills	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Digenea	Bucephalidae	Bucephalidae indet.	body cavity	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Digenea	Bucephalidae	Bucephalidae indet.	body cavity	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Digenea	Didymozoidae	Didymozoidae indet.	body cavity	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Digenea	Didymozoidae	Didymozoidae indet.	body cavity	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Hirudinea	Piscicolidae	Piscicolidae indet.	gills	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Hirudinea	Piscicolidae	Piscicolidae indet.	gills	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Monogenea	Diclidophoridae	*Allotagia otolithis* (Yamaguti, 1953) Dillon & Hargis, 1965	gills	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Monogenea	Diclidophoridae	*Allotagia otolithis* (Yamaguti, 1953) Dillon & Hargis, 1965	gills	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Nematoda	nr	Nematoda indet.	intestine	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Nematoda	nr	Nematoda indet.	intestine	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Nematoda	Raphidascarididae	*Hysterothylacium* spp. (two species/morphotypes)	body cavity	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Nematoda	Raphidascarididae	*Hysterothylacium* spp. (two species/morphotypes)	body cavity	Rückert et al. 2009b

Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	musculature	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	musculature	Rückert et al. 2009b
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Nematoda	Rhadinorhynchidae	*Gorgorhynchus* sp.	intestine	Rückert 2006
Perciformes	Mullidae	*Upeneus vittatus* (Forsskål, 1775)	Nematoda	Rhadinorhynchidae	*Gorgorhynchus* sp.	intestine	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus celebicus* (Bleeker, 1854)	Acanthocephala	Echinorhynchidae	*Acanthocephalus* sp.	(gills)	Pardede 2000
Perciformes	Nemipteridae	*Nemipterus celebicus* (Bleeker, 1854)	Acanthocephala	Echinorhynchidae	*Echinorhynchus* sp.	(gills)	Pardede 2000
Perciformes	Nemipteridae	*Nemipterus celebicus* (Bleeker, 1854)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Pardede 2000
Perciformes	Nemipteridae	*Nemipterus celebicus* (Bleeker, 1854)	Digenea	Didymozoidae	Didymozoidae indet.	intestine	Pardede 2000
Perciformes	Nemipteridae	*Nemipterus celebicus* (Bleeker, 1854)	Nematoda	nr	Nematoda indet. spp. (two species/morphotypes)	intestine	Pardede 2000
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Acanthocephala	nr	Acanthocephala indet.	mesenteries	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Acanthocephala	nr	Acanthocephala indet.	mesenteries	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**mesenteries**	**Present study**
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	mesenteries	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	mesenteries	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Cestoda**	**Lacistorhynchidae**	***Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931**	**body cavity**	**Present study**
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Cestoda	Lacistorhynchidae	*Floriceps minacanthus* Campbell & Beveridge, 1987	mesenteries	Palm 2004
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Cestoda**	**Otobothriidae**	***Symbothriorhynchus* sp.**	**body cavity**	**Present study**
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Cestoda	Tentaculariidae	*Heteronybelinia elongata* (Shah & Bilqees, 1979) Palm, 1999	stomach wall	Palm 2004
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Cestoda	Tentaculariidae	*Heteronybelinia heteromorphi* Palm, 1999	stomach wall	Palm 2004
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Cestoda**	**Tentaculariidae**	***Heteronybelinia* sp.**	**stomach wall**	**Present study**
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Cestoda	Tentaculariidae	*Kotorella pronosoma* (Stossich, 1901) Euzet & Radujkovic, 1989	stomach wall	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Cestoda	Tentaculariidae	*Kotorella pronosoma* (Stossich, 1901) Euzet & Radujkovic, 1989	stomach wall	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Cestoda	Tentaculariidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	musculature	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Cestoda	Tentaculariidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	musculature	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Cestoda**	**Tentaculariidae**	***Nybelinia africana* Dollfus, 1960**	**stomach wall**	**Present study**
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Cestoda	Tentaculariidae	*Nybelinia goreensis* Dollfuss, 1960	stomach wall	Palm 2004
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	stomach	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	stomach	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Crustacea: Copepoda	Bomolochidae	Bomolochidae indet.	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Crustacea: Copepoda	Bomolochidae	Bomolochidae indet.	gills	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Crustacea: Copepoda**	**Bomolochidae**	**Bomolochidae indet.**	**gills**	**Present study**
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Crustacea: Copepoda	Bomolochidae	*Holobomolochus* sp.	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Crustacea: Copepoda	Bomolochidae	*Holobomolochus* sp.	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Crustacea: Copepoda	Bomolochidae	*Holocolax nemipteri* (Pillai, 1973)	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Crustacea: Copepoda	Bomolochidae	*Holocolax nemipteri* (Pillai, 1973)	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Crustacea: Copepoda	Caligidae	Caligidae indet.	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Crustacea: Copepoda	Caligidae	Caligidae indet.	gills	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus nemipteri* Jayasree & Pillai, 1976**	**gills**	**Present study**

Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study**
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Digenea	Didymozoidae	Didymozoidae indet.	intestine	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Digenea	Didymozoidae	Didymozoidae indet.	intestine	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet.**	**operculum**	**Present study**
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Digenea**	**Hemiuridae**	***Lecithochirium* sp.**	**stomach**	**Present study**
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Digenea	nr	Digenea indet. spp. (two species/morphotypes)	intestine	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Digenea	nr	Digenea indet. spp. (two species/morphotypes)	intestine	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Digenea**	**nr**	**Digenea indet. spp. (two species/morphotypes)**	**operculum**	**Present study**
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Monogenea**	**(Polyopisthocotylea)**	**Polyopisthocotylea indet.**	**gills**	**Present study**
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Monogenea	Capsalidae	Capsalidae indet.	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Monogenea	Capsalidae	Capsalidae indet.	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Monogenea	Microcotylidae	*Microcotyle odacis* Sandars, 1945	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Monogenea	Microcotylidae	*Microcotyle odacis* Sandars, 1945	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Monogenea	Microcotylidae	*Microcotyle* sp.	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Monogenea	Microcotylidae	*Microcotyle* sp.	gills	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Monogenea**	**Microcotylidae**	***Microcotyle* sp.**	**gills**	**Present study**
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	guts	Palm & Theisen et al. 2017
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Nematoda**	**Camallanidae**	***Camallanus* sp.**	**intestine**	**Present study**
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	Cucullanidae	*Cucullanus* sp.	stomach	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	Cucullanidae	*Cucullanus* sp.	stomach	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	Gnathostomatidae	*Echinocephalus* sp.	liver	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	Gnathostomatidae	*Echinocephalus* sp.	liver	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	nr	Nematoda indet.	intestine	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	nr	Nematoda indet.	intestine	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Nematoda**	**Philometridae**	***Philometra* cf. *nemipteri* Luo, 2001**	**gonads**	**Present study**
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	Raphidascarididae	*Hysterothylacium* spp. (two species/morphotypes)	guts	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	Raphidascarididae	*Hysterothylacium* spp. (two species/morphotypes)	guts	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* spp. (two species/morphotypes)**	**guts**	**Present study**
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Nematoda**	**Raphidascarididae**	***Raphidascaris* cf. *(Ichthyascaris) nemipteri* Moravec & Justine, 2005**	**mesenteries**	**Present study**
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	Raphidascarididae	*Raphidascaris* sp.[42]	mesenteries	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	Raphidascarididae	*Raphidascaris* sp.[42]	mesenteries	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	Rhadinorhynchidae	*Gorgorhynchus* sp.	intestine	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	Rhadinorhynchidae	*Gorgorhynchus* sp.	intestine	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	Rhadinorhynchidae	*Leptorhynchoides thecatus* (Linton, 1891) Kostylev, 1924	intestine	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus furcosus* (Valenciennes, 1830)	Nematoda	Rhadinorhynchidae	*Leptorhynchoides thecatus* (Linton, 1891) Kostylev, 1924	intestine	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus furcosus* (Valenciennes, 1830)**	**Nematoda**	**Rhadinorhynchidae**	***Serrasentis sagittifer* (Linton, 1889)**	**mesenteries**	**Present study**
Perciformes	Nemipteridae	*Nemipterus hexodon* (Quoy & Gaimard, 1824)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia longigenitalis* Yamaguti, 1954	gills	Yamaguti 1954d
Perciformes	Nemipteridae	*Nemipterus hexodon* (Quoy & Gaimard, 1824)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia synagris* Yamaguti, 1954	gills	Yamaguti 1954d

Perciformes	Nemipteridae	*Nemipterus hexodon* (Quoy & Gaimard, 1824)	Digenea	Apocreadiidae	*Homalometron synagris* (Yamaguti, 1953) Cribb & Bray, 1999	pyloric caeca	Yamaguti 1953b
Perciformes	Nemipteridae	*Nemipterus hexodon* (Quoy & Gaimard, 1824)	Digenea	Lecithasteridae	*Aponurus synagris* Yamaguti, 1953	intestine	Yamaguti 1953b
Perciformes	Nemipteridae	*Nemipterus hexodon* (Quoy & Gaimard, 1824)	Monogenea	Diplectanidae	*Calydiscoides flexuosus* (Yamaguti, 1953) Young, 1969	gills	Yamaguti 1953a
Perciformes	Nemipteridae	*Nemipterus hexodon* (Quoy & Gaimard, 1824)	Monogenea	Diplectanidae	*Protolamellodiscus convolutus* (Yamaguti, 1953) Oliver, 1987	gills	Yamaguti 1953a
Perciformes	Nemipteridae	*Nemipterus hexodon* (Quoy & Gaimard, 1824)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	body cavity	Yamaguti 1954c
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Acanthocephala	nr	Acanthocephala indet.	intestine	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Acanthocephala	nr	Acanthocephala indet.	intestine	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**intestine**	**Present study, workshop Bali**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Acanthocephala	Rhadinorhynchidae	*Gorgorhynchus* sp.	intestine	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Acanthocephala	Rhadinorhynchidae	*Gorgorhynchus* sp.	intestine	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Acanthocephala	Rhadinorhynchidae	*Leptorhynchoides thecatus* (Linton, 1891) Kostylev, 1924	intestine	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Acanthocephala	Rhadinorhynchidae	*Leptorhynchoides thecatus* (Linton, 1891) Kostylev, 1924	intestine	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	guts	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	guts	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	guts	Theisen 2009
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Acanthocephala**	**Rhadinorhynchidae**	***Serrasentis sagittifer* (Linton, 1889)**	**guts**	**Present study, workshop Bali**
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Cestoda**	**(Pseudophyllidea)**	**Pseudophyllidea indet.**	**body cavity**	**Present study, workshop Bali**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	guts	Fitriyanti 2000
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Cestoda**	**Bothriocephalidae**	**Bothriocephalidae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Cestoda**	**Bothriocephalidae**	***Bothriocephalus* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Theisen 2009
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Cestoda**	**Lacistorhynchidae**	***Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931**	**body cavity**	**Present study**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Cestoda	nr	Cestoda indet.	pyloric caeca	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Cestoda	nr	Cestoda indet.	pyloric caeca	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Cestoda**	**Pterobothriidae**	***Pterobothrium* sp.**	**stomach**	**Present study**
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Cestoda**	**Tentaculariidae**	***Kotorella pronosoma* (Stossich, 1901) Euzet & Radujkovic, 1989**	**stomach wall**	**Present study**
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Cestoda**	**Tentaculariidae**	***Nybelinia africana* Dollfus, 1960**	**gill cavity**	**Present study**
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Cestoda**	**Tentaculariidae**	***Nybelinia* cf. *indica* Chandra, 1986**	**gill cavity**	**Present study, workshop Bali**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Crustacea: Copepoda	Bomolochidae	*Holocolax nemipteri* (Pillai, 1973)	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Crustacea: Copepoda	Bomolochidae	Bomolochidae indet.	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Crustacea: Copepoda	Bomolochidae	Bomolochidae indet.	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Crustacea: Copepoda	Bomolochidae	*Holocolax nemipteri* (Pillai, 1973)	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Crustacea: Copepoda	Caligidae	Caligidae indet.	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Crustacea: Copepoda	Caligidae	Caligidae indet.	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Crustacea: Copepoda	Caligidae	Caligidae indet.	gills	Theisen 2009
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *epinepheli* Yamaguti, 1936	gills	Theisen 2009
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* cf. *epinepheli* Yamaguti, 1936**	**gills**	**Present study**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus nemipteri* Jayasree & Pillai, 1976	gills	Theisen 2009
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus nemipteri* Jayasree & Pillai, 1976**	**gills**	**Present study, workshop Bali**

Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Fitriyanti 2000
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Theisen 2009
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Digenea	Bucephalidae	Prosorhynchinae indet.	body cavity	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Digenea	Bucephalidae	Prosorhynchinae indet.	body cavity	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Digenea	Didymozoidae	Didymozoidae indet. spp. (two species)	guts	Fitriyanti 2000
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Digenea	Didymozoidae	Didymozoidae indet. spp. (two species)	guts	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Digenea	Didymozoidae	Didymozoidae indet. spp. (two species)	guts	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Digenea	Didymozoidae	Didymozoidae indet. spp. (two species)	guts	Theisen 2009
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet. spp. (two species)**	**guts**	**Present study**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Digenea	Fellodistomidae	*Monascus* sp.	stomach	Theisen 2009
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Digenea	Hemiuridae	*Aphanurus* sp.	stomach	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Digenea	Hemiuridae	*Aphanurus* sp.	stomach	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Digenea**	**Hemiuridae**	***Aphanurus* sp.**	**stomach**	**Present study**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Digenea	Opecoelidae	*Neochoanostoma* sp.	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Digenea	Opecoelidae	*Neochoanostoma* sp.	gills	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Monogenea**	**(Polyopisthocotylea)**	**Polyopisthocotylea indet.**	**gills**	**Present study, workshop Bali**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Monogenea	Diplectanidae	*Calydiscoides flexuosus* (Yamaguti, 1953) Young, 1969	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Monogenea	Diplectanidae	*Calydiscoides flexuosus* (Yamaguti, 1953) Young, 1969	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Monogenea	Diplectanidae	*Calydiscoides flexuosus* (Yamaguti, 1953) Young, 1969	gills	Theisen 2009
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Monogenea**	**Diplectanidae**	***Calydiscoides flexuosus* (Yamaguti, 1953) Young, 1969**	**gills**	**Present study, workshop Bali**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Monogenea	Diplectanidae	*Calydiscoides scolopsidis* Lim, 2003	gills	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Monogenea	Diplectanidae	*Calydiscoides scolopsidis* Lim, 2003	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Monogenea	Diplectanidae	*Calydiscoides scolopsidis* Lim, 2003	gills	Theisen 2009
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Monogenea**	**Diplectanidae**	***Calydiscoides scolopsidis* Lim, 2003**	**gills**	**Present study, workshop Bali**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Monogenea	Microcotylidae	*Microcotyle* sp.	gills	Fitriyanti 2000
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	guts	Palm & Theisen et al. 2017
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Nematoda**	**Anisakidae**	***Terranova* sp.**	**body cavity**	**Present study**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Theisen 2009
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Nematoda**	**Camallanidae**	***Camallanus carangis* Olsen, 1954**	**intestine**	**Present study**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Nematoda	nr	Nematoda indet.	intestine	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Nematoda	nr	Nematoda indet.	intestine	Rückert et al. 2009b
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Nematoda	Philometridae	*Philometra lateolabracis*[29] (Yamaguti, 1935) Yamaguti, 1961	gonads	Theisen 2009
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Nematoda	Philometridae	*Philometra nemipteri* Luo, 2001	gonads	Dewi & Palm 2017, workshop
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Nematoda**	**Philometridae**	***Philometra nemipteri* Luo, 2001**	**gonads**	**Present study**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Nematoda	Philometridae	*Philometra* sp.	eye cavity	Dewi & Palm 2017, workshop

Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Nematoda**	**Philometridae**	***Philometra* sp.**	**eye cavity**	**Present study**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Nematoda	Philometridae	Philometridae indet.	body cavity	Dewi & Palm 2017, workshop
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Nematoda**	**Philometridae**	**Philometridae indet.**	**body cavity**	**Present study**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Nematoda	Raphidascarididae	*Hysterothylacium* spp. (two species/morphotypes)	mesenteries	Rückert 2006
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Nematoda	Raphidascarididae	*Hysterothylacium* spp. (two species/morphotypes)	mesenteries	Rückert et al. 2009b
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* spp. (two species/morphotypes)**	**mesenteries**	**Present study, workshop Bali**
Perciformes	**Nemipteridae**	***Nemipterus japonicus* (Bloch, 1791)**	**Nematoda**	**Raphidascarididae**	***Raphidascaris* cf. *(Ichthyascaris) nemipteri* Moravec & Justine, 2005**	**mesenteries**	**Present study**
Perciformes	Nemipteridae	*Nemipterus japonicus* (Bloch, 1791)	Nematoda	Raphidascarididae	*Raphidascaris* sp.[42]	mesenteries	Theisen 2009
Perciformes	Nemipteridae	*Nemipterus* sp.	Digenea	Opecoelidae	*Macvicaria synagris* (Yamaguti, 1952) Aken-Ova et al., 2008	pyloric caeca	Yamaguti 1952
Perciformes	Nemipteridae	*Nemipterus* sp.	Monogenea	Capsalidae	*Benedenia synagris* Yamaguti, 1953	gills	Yamaguti 1953a
Perciformes	Nemipteridae	*Nemipterus* sp.	Nematoda	Rhadinorhynchidae	*Gorgorhynchus celebesensis* (Yamaguti, 1954)	intestine	Yamaguti 1954b
Perciformes	**Nemipteridae**	***Scolopsis ciliata* (Lacépède, 1802)**	**Monogenea**	**(Polyopisthocotylea)**	**Polyopisthocotylea indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Nemipteridae**	***Scolopsis ciliata* (Lacépède, 1802)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	**Nemipteridae**	***Scolopsis ciliata* (Lacépède, 1802)**	**Nematoda**	**Camallanidae**	***Camallanus* sp.**	**stomach**	**Present study, workshop Bali**
Perciformes	**Nemipteridae**	***Scolopsis ciliata* (Lacépède, 1802)**	**Nematoda**	**Camallanidae**	***Procamallanus* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Nemipteridae**	***Scolopsis ciliata* (Lacépède, 1802)**	**Nematoda**	**Camallanidae**	***Spirocamallanus* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Nemipteridae**	***Scolopsis monogramma* (Cuvier, 1830)**	**Crustacea: Copepoda**	**Hatschekiidae**	***Hatschekia* spp. (two species/morphotypes)**	**gills**	**Present study, workshop Bali**
Perciformes	**Nemipteridae**	***Scolopsis monogramma* (Cuvier, 1830)**	**Nematoda**	**Cucullanidae**	***Cucullanus* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Acanthocephala	Rhadinorhynchidae	*Gorgorhynchus* sp.	intestine	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Acanthocephala	Rhadinorhynchidae	*Gorgorhynchus* sp.	intestine	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Acanthocephala	Rhadinorhynchidae	*Rhadinorhynchus* sp.	intestine	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Acanthocephala	Rhadinorhynchidae	*Rhadinorhynchus* sp.	intestine	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	guts	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	guts	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Cestoda	Eutetrarhynchidae	*Dollfusiella* sp.	pyloric caeca	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Cestoda	Eutetrarhynchidae	*Dollfusiella* sp.	pyloric caeca	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Crustacea: Copepoda	Bomolochidae	*Holocolax nemipteri* (Pillai, 1973)	gills	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Crustacea: Copepoda	Bomolochidae	*Holocolax nemipteri* (Pillai, 1973)	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia longigenitalis* Yamaguti, 1954	gills	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia longigenitalis* Yamaguti, 1954	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Digenea	Hemiuridae	*Erilepturus neopacificus* (Velasquez, 1962)	gills	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Digenea	Hemiuridae	*Erilepturus neopacificus* (Velasquez, 1962)	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Digenea	nr	Digenea indet.	intestine	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Digenea	nr	Digenea indet.	intestine	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Digenea	Opecoelidae	*Propycnadenoides philippinensis* Fischthal & Kuntz, 1964	intestine	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Digenea	Opecoelidae	*Propycnadenoides philippinensis* Fischthal & Kuntz, 1964	intestine	Rückert et al. 2009b

Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Monogenea	Capsalidae	Capsalidae indet.	gills	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Monogenea	Capsalidae	Capsalidae indet.	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Monogenea	Diplectanidae	*Calydiscoides scolopsidis* Lim, 2003	gills	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Monogenea	Diplectanidae	*Calydiscoides scolopsidis* Lim, 2003	gills	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Nematoda	Anisakidae	*Terranova* sp.	intestine	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Nematoda	Anisakidae	*Terranova* sp.	intestine	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Nematoda	nr	Nematoda indet.	stomach	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Nematoda	nr	Nematoda indet.	stomach	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	mesenteries	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Nematoda	Raphidascarididae	*Hysterothylacium* spp. (two species/morphotypes)	mesenteries	Rückert et al. 2009b
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Nematoda	Raphidascarididae	*Raphidascaris* spp. (two species/morphotypes)	mesenteries	Rückert 2006
Perciformes	Nemipteridae	*Scolopsis taenioptera* (Cuvier, 1830)	Nematoda	Raphidascarididae	*Raphidascaris* spp. (two species/morphotypes)	mesenteries	Rückert et al. 2009b
Perciformes	Nomeidae	*Cubiceps* sp.	Nematoda	(Cystidicolidae)	*Mastigospirura cubicipitis*[35] Machida & Syahailatua, 1994 *nomen dubium*	intestine	Machida & Syahailatua 1994
Perciformes	Pinguipedidae	*Parapercis* sp.	Crustacea: Isopoda	Cymothoidae	*Cymothoa* sp.	mouth	Monod 1976
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Caligidae	*Caligus phipsoni* Bassett-Smith, 1898	gills	Wilson 1912
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Caligidae	*Caligus phipsoni* Bassett-Smith, 1898	gills	Yuniar 2005
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Caligidae	*Caligus phipsoni* Bassett-Smith, 1898	gills	Yuniar et al. 2007
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Caligidae	*Parapetalus hirsutus* (Bassett-Smith, 1898)	gills	Wilson 1912
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Caligidae	*Parapetalus hirsutus* (Bassett-Smith, 1898)	gills	Yuniar 2005
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Caligidae	*Parapetalus hirsutus* (Bassett-Smith, 1898)	gills	Yuniar et al. 2007
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Lernaeopodidae	*Naobranchia* cf. *polynemi* Tripathi, 1962	gills	Yuniar 2005
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Lernaeopodidae	*Naobranchia* cf. *polynemi* Tripathi, 1963	gills	Yuniar et al. 2007
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus polynemi* Richiardi, 1881	gills	Bleeker 1857
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus polynemi* Richiardi, 1881	gills	Piasecki & Hayward 2002
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus polynemi* Richiardi, 1881	gills	Richiardi 1881a
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus polynemi* Richiardi, 1881	gills	Richiardi 1881b
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus polynemi* Richiardi, 1881	gills	Wilson 1912
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus polynemi* Richiardi, 1881	gills	Yuniar 2005
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus polynemi* Richiardi, 1881	gills	Yuniar et al. 2007
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Monogenea	Microcotylidae	*Microcotyle* cf. *polynemi* McCallum, 1917	gills	Rückert et al. 2009a
Perciformes	Polynemidae	*Eleutheronema tetradactylum* (Shaw, 1804)	Monogenea	Microcotylidae	*Microcotyle* cf. *polynemi* McCallum, 1917	gills	Yuniar 2005
Perciformes	**Polynemidae**	***Polydactylus plebeius* (Broussonet, 1782)**	**Cestoda**	**Eutetrarhynchidae**	***Dollfusiella* sp.**	**stomach**	**Present study, workshop Bali**
Perciformes	**Polynemidae**	***Polydactylus plebeius* (Broussonet, 1782)**	**Cestoda**	**Polypocephalidae**	***Polypocephalus* sp.**	**stomach**	**Present study, workshop Bali**
Perciformes	**Polynemidae**	***Polydactylus plebeius* (Broussonet, 1782)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* cf. *phipsoni* Bassett-Smith, 1898**	**gills**	**Present study, workshop Bali**
Perciformes	**Polynemidae**	***Polydactylus plebeius* (Broussonet, 1782)**	**Crustacea: Copepoda**	**Taeniacanthidae**	**Taeniacanthidae indet.**	**fins base**	**Present study, workshop Bali**
Perciformes	**Polynemidae**	***Polydactylus plebeius* (Broussonet, 1782)**	**Nematoda**	**Camallanidae**	***Spirocamallanus* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	**Polynemidae**	***Polydactylus plebeius* (Broussonet, 1782)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	Polynemidae	*Polynemus* cf. *paradiseus* Linnaeus, 1758	Crustacea: Iopoda	Cymothoidae	*Nerocila phaiopleura* Bleeker, 1857	nr	Nierstrasz 1931
Perciformes	Polynemidae	*Polynemus* cf. *paradiseus* Linnaeus, 1758	Crustacea: Iopoda	Cymothoidae	*Nerocila phaiopleura* Bleeker, 1857	nr	Sidabalok 2013
Perciformes	Polynemidae	*Polynemus* cf. *paradiseus* Linnaeus, 1758	Crustacea: Iopoda	Cymothoidae	*Nerocila phaiopleura* Bleeker, 1857	nr	Trilles 1979

Perciformes	Polynemidae	*Polynemus* cf. *paradiseus* Linnaeus, 1758	Monogenea	Microcotylidae	*Polynemicola polynemi* (MacCallum, 1917)	gills	MacCallum 1917
Perciformes	Pomacanthidae	*Pomacanthus imperator* (Bloch, 1787)	Crustacea: Copepoda	Pennellidae	*Lernaeenicus gnathonicus* Leigh-Sharpe, 1934	nr	Leigh-Sharpe 1934
Perciformes	Pomacentridae	*Abudefduf* (*Glyphidodon*) sp.	Crustacea: Iopoda	Cymothoidae	*Renocila ovata* Miers, 1880	surface	Nierstrasz 1931
Perciformes	Pomacentridae	*Abudefduf saxatilis* (Linnaeus, 1758)	Crustacea: Iopoda	Cymothoidae	*Renocila* cf. *ovata* Miers, 1880	nr	Evans et al. 1995
Perciformes	**Pomacentridae**	***Abudefduf vaigiensis* (Quoy & Gaimard, 1825)**	**Cestoda**	**Lacistorhynchidae**	***Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931**	**intestine**	**Present study, workshop Bali**
Perciformes	Pomacentridae	*Abudefduf vaigiensis* (Quoy & Gaimard, 1825)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Muthmainnah 2004
Perciformes	Pomacentridae	*Abudefduf vaigiensis* (Quoy & Gaimard, 1825)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Slade 2001
Perciformes	**Pomacentridae**	***Abudefduf vaigiensis* (Quoy & Gaimard, 1825)**	**Crustacea: Copepoda**	**Hatschekiidae**	***Hatschekia* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	**Pomacentridae**	***Abudefduf vaigiensis* (Quoy & Gaimard, 1825)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	Pomacentridae	*Chromis caerulea* (Cuvier, 1830)	Crustacea: Copepoda	Pennellidae	*Peniculus elegans* Leig-Sharpe, 1934	nr	Leigh-Sharpe 1934
Perciformes	Pomacentridae	*Chrysiptera biocellata* (Quoy & Gaimard, 1825)	Crustacea: Copepoda	Caligidae	Caligidae indet.	nr	Leigh-Sharpe 1930, 1934? No!
Perciformes	Pomacentridae	*Chrysiptera biocellata* (Quoy & Gaimard, 1825)	Crustacea: Iopoda	Cymothoidae	*Renocila ovata* Miers, 1880	surface	Nierstrasz 1931
Perciformes	Pomacentridae	Pomacentridae indet.	Crustacea: Copepoda	Caligidae	*Caligus eventilis* Leig-Sharpe, 1934	nr	Leigh-Sharpe 1934
Perciformes	Pomacentridae	Pomacentridae indet.	Crustacea: Iopoda	Cymothoidae	*Renocila ovata* Miers, 1880	surface	Bruce 1987a
Perciformes	Pomacentridae	Pomacentridae indet.	Crustacea: Iopoda	Cymothoidae	*Renocila ovata* Miers, 1880	surface	Sidabalok 2013
Perciformes	Pomacentridae	*Pomacentrus trilineatus* Cuvier, 1830	Crustacea: Copepoda	Caligidae	Caligidae indet.	nr	Leigh-Sharpe 1930, 1934? No!
Perciformes	Priacanthidae	Priacanthidae indet.	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus larvatus* Heller, 1865	surface	Heller 1865
Perciformes	Priacanthidae	*Priacanthus hamrur* (Forsskål, 1775)	Cestoda	Lacistorhynchidae	*Pseudogrillotia multiminacantha* Palm, 2004	body cavity	Palm 2004
Perciformes	Priacanthidae	*Priacanthus hamrur* (Forsskål, 1775)	Digenea	Hemiuridae	*Lecithochirium priacanthi* Yamaguti, 1953	stomach	Yamaguti 1953b
Perciformes	**Priacanthidae**	***Priacanthus hamrur* (Forsskål, 1775)**	**Digenea**	**Opecoelidae**	***Pseudopecoeloides* cf. *tenuis* Yamaguti, 1940**	**guts**	**Present study, workshop Bali**
Perciformes	Priacanthidae	*Priacanthus hamrur* (Forsskål, 1775)	Digenea	Opecoelidae	*Pseudopecoeloides tenuis* Yamaguti, 1940	pyloric caeca	Yamaguti 1953b
Perciformes	**Priacanthidae**	***Priacanthus hamrur* (Forsskål, 1775)**	**Monogenea**	**Diplectanidae**	**Diplectanidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	Priacanthidae	*Priacanthus macracanthus* Cuvier, 1829	Acanthocephala	Echinorhynchidae	Echinorhynchidae indet.	intestine	Fitriyanti 2000
Perciformes	Priacanthidae	*Priacanthus macracanthus* Cuvier, 1829	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Fitriyanti 2000
Perciformes	Priacanthidae	*Priacanthus macracanthus* Cuvier, 1829	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	stomach wall	Palm 2004
Perciformes	Priacanthidae	*Priacanthus macracanthus* Cuvier, 1829	Crustacea: Copepoda	Ergasilidae	*Ergasilus* sp.	gills	Fitriyanti 2000
Perciformes	Priacanthidae	*Priacanthus macracanthus* Cuvier, 1829	Digenea	Didymozoidae	*Neometadidymozoon polymorphis* (Oschmarin & Mamaev, 1963) Yamaguti, 1971	fins, opercula	Fitriyanti 2000
Perciformes	Priacanthidae	*Priacanthus macracanthus* Cuvier, 1829	Digenea	Opecoelidae	*Pseudopecoeloides* sp.[21]	pyloric caeca	Fitriyanti 2000
Perciformes	Priacanthidae	*Priacanthus macracanthus* Cuvier, 1829	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Fitriyanti 2000
Perciformes	Priacanthidae	*Priacanthus macracanthus* Cuvier, 1829	Nematoda	Capillariidae	*Capillaria* sp.	stomach	Fitriyanti 2000
Perciformes	Priacanthidae	*Priacanthus tayenus* Richardson, 1846	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Kayuzi 2014
Perciformes	**Priacanthidae**	***Priacanthus tayenus* Richardson, 1846**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**intestine**	**Present study**
Perciformes	Priacanthidae	*Priacanthus tayenus* Richardson, 1846	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	intestine	Kayuzi 2014
Perciformes	**Priacanthidae**	***Priacanthus tayenus* Richardson, 1846**	**Cestoda**	**Lacistorhynchidae**	***Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931**	**intestine**	**Present study**
Perciformes	Priacanthidae	*Priacanthus tayenus* Richardson, 1846	Cestoda	nr	Trypanorhyncha indet.	intestine	Kayuzi 2014
Perciformes	**Priacanthidae**	***Priacanthus tayenus* Richardson, 1846**	**Cestoda**	**nr**	**Trypanorhyncha indet.**	**intestine**	**Present study**
Perciformes	**Priacanthidae**	***Priacanthus tayenus* Richardson, 1846**	**Crustacea: Copepoda**	**Caligidae**	***Sinocaligus caudatus* (Gnanamuthu, 1950)**	**gills**	**Present study**
Perciformes	**Priacanthidae**	***Priacanthus tayenus* Richardson, 1846**	**Crustacea: Copepoda**	**Lernanthropidae**	***Norion tayenus* Ho & Kim I.H., 2004**	**gills**	**Present study**
Perciformes	**Priacanthidae**	***Priacanthus tayenus* Richardson, 1846**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**operculum**	**Present study**

Perciformes	Priacanthidae	*Priacanthus tayenus* Richardson, 1846	Digenea	Didymozoidae	*Neometadidymozoon polymorphis* (Oschmarin & Mamaev, 1963) Yamaguti, 1971	fins, opercula	Kayuzi 2014
Perciformes	**Priacanthidae**	***Priacanthus tayenus* Richardson, 1846**	**Digenea**	**Didymozoidae**	***Neometadidymozoon polymorphis* (Oschmarin & Mamaev, 1963) Yamaguti, 1971**	**fins, opercula**	**Present study**
Perciformes	**Priacanthidae**	***Priacanthus tayenus* Richardson, 1846**	**Digenea**	**Hemiuridae**	***Lecithochirium* cf. *priacanthi* Yamaguti, 1953**	**stomach**	**Present study**
Perciformes	Priacanthidae	*Priacanthus tayenus* Richardson, 1846	Digenea	Hemiuridae	*Lecithochirium* sp.[14]	stomach	Kayuzi 2014
Perciformes	Priacanthidae	*Priacanthus tayenus* Richardson, 1846	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Kayuzi 2014
Perciformes	Priacanthidae	*Priacanthus tayenus* Richardson, 1846	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Utami 2014
Perciformes	Priacanthidae	*Priacanthus tayenus* Richardson, 1846	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017, workshop
Perciformes	**Priacanthidae**	***Priacanthus tayenus* Richardson, 1846**	**Nematoda**	**Camallanidae**	***Camallanus* cf. *priacanthi* Kataytseva, 1975**	**intestine**	**Present study**
Perciformes	Priacanthidae	*Priacanthus tayenus* Richardson, 1846	Nematoda	Camallanidae	*Camallanus* sp.[32]	intestine	Kayuzi 2014
Perciformes	**Priacanthidae**	***Priacanthus tayenus* Richardson, 1846**	**Nematoda**	**Philometridae**	***Philometra* cf. *priacanthi* Moravec & Justine, 2009**	**body cavity**	**Present study**
Perciformes	Priacanthidae	*Priacanthus tayenus* Richardson, 1846	Nematoda	Philometridae	*Philometra* sp.[36]	body cavity	Kayuzi 2014
Perciformes	Priacanthidae	*Priacanthus tayenus* Richardson, 1846	Nematoda	Raphidascarididae	*Hysterothylacium* spp. (two species/morphotypes)	body cavity	Kayuzi 2014
Perciformes	**Priacanthidae**	***Priacanthus tayenus* Richardson, 1846**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* spp. (two species/morphotypes)**	**body cavity**	**Present study**
Perciformes	**Rachycentridae**	***Rachycentron canadum* (L.)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Rachycentridae**	***Rachycentron canadum* (L.)**	**Acanthocephala**	**Rhadinorhynchidae**	***Serrasentis sagittifer* (Linton, 1889)**	**guts**	**Present study, workshop Bali**
Perciformes	**Rachycentridae**	***Rachycentron canadum* (L.)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**intestine**	**Present study, workshop Bali**
Perciformes	Rachycentridae	*Rachycentron canadum* (L.)	Cestoda	Tentacularidae	*Tentacularia coryphaenae* Bosc, 1802	musculature	Palm 2004
Perciformes	**Rachycentridae**	***Rachycentron canadum* (L.)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**operculum**	**Present study, workshop Bali**
Perciformes	Rachycentridae	*Rachycentron canadum* (L.)	Nematoda	Philometridae	*Philometroides marinus* Moravec & Buron, 2009	on swimbladder	Dewi & Palm 2017, workshop
Perciformes	**Rachycentridae**	***Rachycentron canadum* (L.)**	**Nematoda**	**Raphidascarididae**	***Iheringascaris inquies* (Linton, 1901) Deardorff & Overstreet, 1980**	**stomach**	**Present study, workshop Bali**
Perciformes	**Scaridae**	***Scarus rubroviolaceus* Bleeker, 1847**	**Digenea**	**Opecoelidae**	***Diplobulbus* cf. *scari* Yamaguti, 1952**	**intestine**	**Present study, workshop Bali**
Perciformes	Scaridae	*Scarus* sp.	Digenea	Opecoelidae	*Diplobulbus scari* Yamaguti, 1952	intestine	Yamaguti 1952
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Acanthocephala	Cavisomidae	*Filisoma indicum* van Cleave, 1928	intestine	Yamaguti 1954b
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Acanthocephala	Cavisomidae	*Filisoma rizalinum* Tubangui & Masiluñgan, 1946	intestine	Kleinertz 2010
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Acanthocephala	Cavisomidae	*Filisoma rizalinum* Tubangui & Masiluñgan, 1946	intestine	Rückert et al. 2009a
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Acanthocephala	Cavisomidae	*Filisoma rizalinum* Tubangui & Masiluñgan, 1946	intestine	Verweyen et al. 2011
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Acanthocephala	Cavisomidae	*Filisoma rizalinum* Tubangui & Masiluñgan, 1946	intestine	Yuniar 2005
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Cestoda	Bothriocephalidae	*Bothriocephalus* sp.	stomach	Kleinertz 2010
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp. (four species)	surface	Kleinertz 2010
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp. (four species)	surface	Muthmainnah 2004
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp. (four species)	surface	Slade 2001
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp. (four species)	surface	Yuniar 2005
Perciformes	**Scatophagidae**	***Scatophagus argus* (Linnaeus, 1766)**	**Ciliophora: Mobilida**	**Trichodinidae**	***Trichodina* spp. (four species)**	**surface**	**Present study, workshop Bali**
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Copepoda	Caligidae	*Caligus acanthopagri* Lin, Ho & Chen, 1994	gills	Kleinertz 2010
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Copepoda	Caligidae	*Caligus acanthopagri* Lin, Ho & Chen, 1994	gills	Yuniar 2005
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Copepoda	Caligidae	*Caligus acanthopagri* Lin, Ho & Chen, 1994	gills	Yuniar et al. 2007
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Copepoda	Caligidae	*Caligus epidemicus* Hewitt, 1971	surface	Yuniar 2005
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Copepoda	Caligidae	*Caligus epidemicus* Hewitt, 1971	surface	Yuniar et al. 2007
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Copepoda	Ergasilidae	*Ergasilus* spp. (two species/morphotypes)	gill cavity	Kleinertz 2010

Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Copepoda	Ergasilidae	*Ergasilus* spp. (two species/morphotypes)	gill cavity	Yuniar 2005
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Copepoda	Ergasilidae	*Ergasilus* spp. (two species/morphotypes)	gill cavity	Yuniar et al. 2007
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Copepoda	Lernaeopodidae	*Thysanote chalermwati* Piasecki, Ohtsuka & Yoshizaki, 2008	surface	Yuniar 2005
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Copepoda	Lernaeopodidae	*Thysanote chalermwati* Piasecki, Ohtsuka & Yoshizaki, 2008	surface	Yuniar et al. 2007
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Copepoda	Pennellidae	Pennellidae indet.	gills	Kleinertz 2010
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Iopoda	Cymothoidae	*Nerocila sundaica* Bleeker, 1857	nr	Nierstrasz 1931
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Iopoda	Cymothoidae	*Nerocila sundaica* Bleeker, 1857	nr	Sidabalok 2013
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Iopoda	Cymothoidae	*Nerocila sundaica* Bleeker, 1857	nr	Trilles 1979
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Isopoda	Cymothoidae	*Cymothoa elegans* Bovallius, 1885	mouth	Kleinertz 2010
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Isopoda	Cymothoidae	*Cymothoa elegans* Bovallius, 1885	mouth	Nierstrasz 1931
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Isopoda	Cymothoidae	*Cymothoa elegans* Bovallius, 1885	mouth	Sidabalok 2013
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Isopoda	Cymothoidae	*Cymothoa elegans* Bovallius, 1885	mouth	Yuniar 2005
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Isopoda	Cymothoidae	*Cymothoa elegans* Bovallius, 1885	mouth	Yuniar et al. 2007
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Kleinertz 2010
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Yuniar 2005
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Yuniar et al. 2007
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Digenea	Bucephalidae	*Prosorhynchus* sp.	stomach	Kleinertz 2010
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Digenea	Faustulidae	*Paradiscogaster farooqii* Hafeezullah & Siddiqi, 1970	stomach	Kleinertz 2010
Perciformes	**Scatophagidae**	***Scatophagus argus* (Linnaeus, 1766)**	**Digenea**	**Haploporidae**	***Capitimitta costata* Pulis & Overstreet, 2013**	**stomach**	**Present study, workshop Bali**
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Digenea	Haploporidae	*Pseudohapladena scatophagi* Yamaguti, 1952	intestine	Yuniar 2005
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Digenea	Haploporidae	*Waretrema pisciolum* Srivastava, 1939	intestine	Yamaguti 1952
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Hirudinea	Piscicolidae	*Zeylanicobdella arugamensis* De Silva, 1963	surface	Rückert et al. 2009a
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Hirudinea	Piscicolidae	*Zeylanicobdella arugamensis* De Silva, 1963	surface	Yuniar 2005
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Microsporea	nr	Microsporea indet.	stomach	Kleinertz 2010
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Monogenea	Ancyrocephalidae	*Metahaliotrema scatophagi* Yamaguti, 1953	gills	Kleinertz 2010
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Monogenea	Ancyrocephalidae	*Metahaliotrema scatophagi* Yamaguti, 1953	gills	Palm & Rückert 2009
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Monogenea	Ancyrocephalidae	*Metahaliotrema scatophagi* Yamaguti, 1953	gills	Rückert et al. 2009a
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Monogenea	Ancyrocephalidae	*Metahaliotrema scatophagi* Yamaguti, 1953	gills	Yamaguti 1953a
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Monogenea	Ancyrocephalidae	*Metahaliotrema scatophagi* Yamaguti, 1953	gills	Yuniar 2005
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Nematoda	Camallanidae	*Procamallanus* sp.	intestine	Rückert et al. 2009a
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Nematoda	Camallanidae	*Procamallanus* sp.	intestine	Yuniar 2005
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Nematoda	Capillariidae	*Capillaria* sp.	stomach	Rückert et al. 2009a
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Nematoda	Capillariidae	*Capillaria* sp.	stomach	Yuniar 2005
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Nematoda	Cucullanidae	*Cucullanus* sp.	intestine	Kleinertz 2010
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Nematoda	Cucullanidae	*Cucullanus* sp.	intestine	Rückert et al. 2009a
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Nematoda	Cucullanidae	*Cucullanus* sp.	intestine	Yuniar 2005
Perciformes	Scatophagidae	*Scatophagus argus* (Linnaeus, 1766)	Nematoda	nr	Nematoda indet.	intestine	Kleinertz 2010
Perciformes	Sciaenidae	*Atrobucca brevis* Sasaki & Kailola, 1988	Cestoda	Lacistorhynchidae	*Grillotia (Christianella) yuniariae* Palm, 2004	liver	Palm 2004
Perciformes	Sciaenidae	*Atrobucca nibe* (Jordan & Thompson, 1911)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Tobing 2000
Perciformes	Sciaenidae	*Atrobucca nibe* (Jordan & Thompson, 1911)	Cestoda	Lacistorhynchidae	*Grillotia (Christianella) yuniariae* Palm, 2004	body cavity	Palm 2004

Perciformes	Sciaenidae	*Atrobucca nibe* (Jordan & Thompson, 1911)	Cestoda	Lacistorhynchidae	*Grillotia* sp.	intestine	Tobing 2000
Perciformes	Sciaenidae	*Atrobucca nibe* (Jordan & Thompson, 1911)	Digenea	Opecoelidae	cf. *Helicometrina* sp. (as *Horatrema* sp.)	body cavity	Tobing 2000
Perciformes	Sciaenidae	*Atrobucca nibe* (Jordan & Thompson, 1911)	Monogenea	nr	Monogenea indet.	gills	Tobing 2000
Perciformes	Sciaenidae	*Atrobucca nibe* (Jordan & Thompson, 1911)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Tobing 2000
Perciformes	Sciaenidae	*Atrobucca nibe* (Jordan & Thompson, 1911)	Nematoda	Ascarididae	Ascarididae indet. (as *Porrocaecum* sp.)	body cavity	Tobing 2000
Perciformes	**Sciaenidae**	***Johnius amblycephalus* (Bleeker, 1855)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Sciaenidae**	***Johnius amblycephalus* (Bleeker, 1855)**	**Crustacea: Copepoda**	**Philichthyidae**	***Colobomatus* cf. *sciaenae* (Richiardi, 1876)**	**nr**	**Present study, workshop Bali**
Perciformes	**Sciaenidae**	***Johnius amblycephalus* (Bleeker, 1855)**	**Digenea**	**Cryptogonimidae**	***Euryakaina* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	**Sciaenidae**	***Johnius amblycephalus* (Bleeker, 1855)**	**Digenea**	**Hemiuridae**	***Qadriana* cf. *fusiformis* Bilqees, 1971**	**stomach**	**Present study**
Perciformes	**Sciaenidae**	***Johnius amblycephalus* (Bleeker, 1855)**	**Digenea**	**Monorchiidae**	**Monorchiidae indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Sciaenidae**	***Johnius amblycephalus* (Bleeker, 1855)**	**Digenea**	**Opecoelidae**	***Helicometrina* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	Sciaenidae	*Johnius amblycephalus* (Bleeker, 1855)	Monogenea	Ancyrocephalidae	*Pseudempleurosoma haywardi* Theisen et al., 2017	pharynx	Theisen et al. 2017
Perciformes	**Sciaenidae**	***Johnius amblycephalus* (Bleeker, 1855)**	**Nematoda**	**Camallanidae**	***Spirocamallanus* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	**Sciaenidae**	***Johnius amblycephalus* (Bleeker, 1855)**	**Nematoda**	**nr**	**Nematoda indet.**	**guts**	**Present study, workshop Bali**
Perciformes	**Sciaenidae**	***Johnius belangerii* (Cuvier, 1830)**	**Nematoda**	**Camallanidae**	***Spirocamallanus* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	Sciaenidae	*Johnius borneensis* (Bleeker, 1851)	Cestoda	Rhinoptericolidae	Rhinoptericolidae indet. (sp. nov.)	stomach	Theisen 2009
Perciformes	Sciaenidae	*Johnius borneensis* (Bleeker, 1851)	Cestoda	Tentacularidae	*Nybelinia* sp.	stomach	Theisen 2009
Perciformes	Sciaenidae	*Johnius borneensis* (Bleeker, 1851)	Crustacea: Copepoda	Bomolochidae	*Bomolochus* sp.	gills	Theisen 2009
Perciformes	Sciaenidae	*Johnius borneensis* (Bleeker, 1851)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus gisleri* Van Beneden, 1852	gills	Theisen 2009
Perciformes	Sciaenidae	*Johnius borneensis* (Bleeker, 1851)	Digenea	Hemiuridae	Hemiuridae indet.	stomach	Theisen 2009
Perciformes	Sciaenidae	*Johnius borneensis* (Bleeker, 1851)	Monogenea	Ancyrocephalidae	Microcotyloidea indet.[26]	pharynx	Theisen 2009
Perciformes	Sciaenidae	*Johnius borneensis* (Bleeker, 1851)	Nematoda	Camallanidae	*Procamallanus* sp.	intestine	Theisen 2009
Perciformes	Sciaenidae	*Johnius borneensis* (Bleeker, 1851)	Nematoda	Philometridae	*Philometra lateolabracis*[29] (Yamaguti, 1935) Yamaguti, 1961	gonads	Theisen 2009
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	mesenteries	Theisen 2009
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	mesenteries	Verweyen et al. 2011
Perciformes	**Sciaenidae**	***Johnius coitor* (Hamilton, 1822)**	**Acanthocephala**	**Rhadinorhynchidae**	***Serrasentis sagittifer* (Linton, 1889)**	**mesenteries**	**Present study**
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Cestoda	Tentacularidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	stomach wall	Rückert et al. 2009a
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Cestoda	Tentacularidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	stomach wall	Yuniar 2005
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *epinepheli* Yamaguti, 1936	gills	Theisen 2009
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *epinepheli* Yamaguti, 1936	gills	Yuniar 2005
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *epinepheli* Yamaguti, 1936	gills	Yuniar et al. 2007
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Crustacea: Copepoda	Lernaeopodidae	Lernaeopodidae indet. (sp. nov.)	gills	Theisen 2009
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus* cf. *gisleri* Van Beneden, 1852	gills	Yuniar 2005
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus* cf. *gisleri* Van Beneden, 1852	gills	Yuniar et al. 2007
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Crustacea: Copepoda	Pennellidae	cf. *Propeniculus scomberi* (Gnanamuthu, 1951)	fins	Yuniar 2005
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Crustacea: Copepoda	Pennellidae	cf. *Propeniculus scomberi* (Gnanamuthu, 1951)	fins	Yuniar et al. 2007
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Digenea	Bucephalidae	Bucephalidae indet.	stomach	Theisen 2009
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Digenea	Didymozoidae	Didymozoidae indet.	intestine	Rückert et al. 2009a
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Digenea	Didymozoidae	Didymozoidae indet.	intestine	Theisen 2009
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Digenea	Didymozoidae	Didymozoidae indet.	intestine	Yuniar 2005

Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Digenea	Hemiuridae	Hemiuridae indet.	stomach	Theisen 2009
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Digenea	Hemiuridae	*Qadriana fusiformis* Bilqees. 1971	stomach	Theisen 2009
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Digenea	Opecoelidae	Oepecoelide indet.[20]	guts	Theisen 2009
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Monogenea	Ancyrocephalidae	*Pseudempleurosoma haywardi* Theisen et al., 2017	pharynx	Theisen et al. 2017
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Monogenea	Diclidophoridae	*Choricotyle* sp.	gills	Theisen 2009
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Monogenea	Microcotylidae	Microcotylidae indet.	gills	Rückert et al. 2009a
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Monogenea	Microcotylidae	Microcotylidae indet.	gills	Theisen 2009
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Monogenea	Microcotylidae	Microcotylidae indet.	gills	Yuniar 2005
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Nematoda	Anisakidae	*Anisakis* sp.[30]	stomach wall	Rückert et al. 2009a
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Nematoda	Anisakidae	*Anisakis* sp.[30]	stomach wall	Yuniar 2005
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Nematoda	Camallanidae	*Procamallanus* sp.	intestine	Rückert et al. 2009a
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Nematoda	Camallanidae	*Procamallanus* sp.	intestine	Theisen 2009
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Nematoda	Camallanidae	*Procamallanus* sp.	intestine	Yuniar 2005
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Nematoda	Philometridae	*Philometra lateolabracis*[29] (Yamaguti, 1935) Yamaguti, 1961	gonads	Theisen 2009
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Nematoda	Philometridae	*Philometra* sp.[37]	gonads	Rückert et al. 2009a
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Nematoda	Philometridae	*Philometra* sp.[37]	gonads	Yuniar 2005
Perciformes	Sciaenidae	*Johnius coitor* (Hamilton, 1822)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	intestine	Theisen 2009
Perciformes	Sciaenidae	*Johnius macropterus* (Bleeker, 1853)	Digenea	Bucephalidae	*Rhipidocotyle jayai* Bray & Palm, 2009	intestine	Bray & Palm 2009
Perciformes	Sciaenidae	*Johnius macropterus* (Bleeker, 1853)	Digenea	Bucephalidae	*Rhipidocotyle jayai* Bray & Palm, 2009	intestine	Bray et al. 2018
Perciformes	**Sciaenidae**	***Johnius macropterus* (Bleeker, 1853)**	**Nematoda**	**Camallanidae**	***Spirocamallanus* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**mesenteries**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Cestoda**	**(Pseudophyllidea)**	**Pseudophyllidea indet.**	**body cavity**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Cestoda**	**nr**	**Trypanorhyncha indet.**	**stomach wall**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* cf. *epinepheli* Yamaguti, 1936**	**gills**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Crustacea: Copepoda**	**Lernaeopodidae**	**Lernaeopodidae indet. (sp. nov.)**	**gills**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus* cf. *gisleri* Van Beneden, 1852**	**gills**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Crustacea: Copepoda**	**Philichthyidae**	***Colobomatus* cf. *sciaenae* (Richiardi, 1876)**	**lateral line canal**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Digenea**	**Bucephalidae**	**cf. *Rhipidocotyle jayai* Bray & Palm, 2009**	**intestine**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet.**	**gill cavity**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Digenea**	**Echinostomatidae**	***Echinostoma* sp.**	**gill cavity**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Digenea**	**Hemiuridae**	**Hemiuridae indet.**	**stomach**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Digenea**	**Hemiuridae**	***Qadriana fusiformis* Bilqees. 1971**	**stomach**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Digenea**	**Lecithasteridae**	**cf. *Aponurus* sp.**	**stomach**	**Present study**
Perciformes	Sciaenidae	*Nibea soldado* (Lacépède, 1802)	Monogenea	Ancyrocephalidae	*Pseudempleurosoma haywardi* Theisen et al., 2017	pharynx	Theisen et al. 2017
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Monogenea**	**nr**	**Monogenea indet.**	**gills**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Monogenea**	**nr**	**Monopisthocotylea indet. (haptor with "tentacles")**	**gills**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Nematoda**	**Anisakidae**	***Terranova* sp.**	**mesenteries**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Nematoda**	**Camallanidae**	***Procamallanus* sp.**	**intestine**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Nematoda**	**Cucullanidae**	***Cucullanus* sp.**	**intestine**	**Present study**

Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Nematoda**	**Philometridae**	***Philometra* cf. *sciaenae* Yamaguti, 1941**	**gonads**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Nematoda**	**Philometridae**	***Philometroides* sp.**	**fin (caudal)**	**Present study**
Perciformes	**Sciaenidae**	***Nibea soldado* (Lacépède, 1802)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* spp. (two species/morphotypes)**	**body cavity**	**Present study**
Perciformes	**Sciaenidae**	***Otolithes ruber* (Bloch & Schneider, 1801)**	**Acanthocephala**	**Echinorhynchidae**	***Echinorhynchus* sp.**	**mesenteries**	**Present study**
Perciformes	**Sciaenidae**	***Otolithes ruber* (Bloch & Schneider, 1801)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**mesenteries**	**Present study**
Perciformes	Sciaenidae	*Otolithes ruber* (Bloch & Schneider, 1801)	Cestoda	Tentaculariidae	*Heteronybelinia estigmena* (Dollfus, 1960) Palm, 1999	mouth cavity	Palm 2004
Perciformes	Sciaenidae	*Otolithes ruber* (Bloch & Schneider, 1801)	Cestoda	Tentaculariidae	*Nybelinia* sp.	musculature	Palm 2004
Perciformes	Sciaenidae	*Otolithes ruber* (Bloch & Schneider, 1801)	Crustacea: Copepoda	Caligidae	*Caligus epinepheli* Yamaguti, 1936	gills	Yamaguti 1954d
Perciformes	**Sciaenidae**	***Otolithes ruber* (Bloch & Schneider, 1801)**	**Crustacea: Copepoda**	**Lernaeopodidae**	**Lernaeopodidae indet. (sp. nov.)**	**gills**	**Present study, workshop Bali**
Perciformes	**Sciaenidae**	***Otolithes ruber* (Bloch & Schneider, 1801)**	**Crustacea: Copepoda**	**Lernaeopodidae**	***Parabrachiella* sp.**	**inner operculum**	**Present study, workshop Bali**
Perciformes	**Sciaenidae**	***Otolithes ruber* (Bloch & Schneider, 1801)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus* cf. *gisleri* Van Beneden, 1852**	**gills**	**Present study**
Perciformes	**Sciaenidae**	***Otolithes ruber* (Bloch & Schneider, 1801)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study**
Perciformes	**Sciaenidae**	***Otolithes ruber* (Bloch & Schneider, 1801)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet.**	**gill cavity**	**Present study**
Perciformes	**Sciaenidae**	***Otolithes ruber* (Bloch & Schneider, 1801)**	**Digenea**	**nr**	**Digenea indet. spp. (three species/morphotypes)**	**gonads**	**Present study**
Perciformes	Sciaenidae	*Otolithes ruber* (Bloch & Schneider, 1801)	Monogenea	Ancyrocephalidae	*Pseudempleurosoma haywardi* Theisen et al., 2017	pharynx	Theisen et al. 2017
Perciformes	Sciaenidae	*Otolithes ruber* (Bloch & Schneider, 1801)	Monogenea	Diclidophoridae	*Allotagia otolithis* (Yamaguti, 1953) Dillon & Hargis, 1965	gills	Yamaguti 1953a
Perciformes	Sciaenidae	*Otolithes ruber* (Bloch & Schneider, 1801)	Nematoda	Philometridae	*Philometra otolithi* Moravec & Manoharan, 2013	gonads	Dewi & Palm 2017, workshop
Perciformes	Sciaenidae	*Otolithes ruber* (Bloch & Schneider, 1801)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	body cavity	Yamaguti 1954c
Perciformes	**Sciaenidae**	***Otolithes ruber* (Bloch & Schneider, 1801)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**body cavity**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Acanthocephala**	**Rhadinorhynchidae**	***Serrasentis sagittifer* (Linton, 1889)**	**mesenteries**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Cestoda**	**Lacistorhynchidae**	***Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931**	**body cavity**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Cestoda**	**Otobothriidae**	***Proemotobothrium southwelli* Beveridge & Campbell, 2001**	**gill cavity**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Cestoda**	**Tentaculariidae**	***Heteronybelinia* sp.**	**stomach wall**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Cestoda**	**Tentaculariidae**	***Kotorella pronosoma* (Stossich, 1901) Euzet & Radujkovic, 1989**	**mesenteries**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Cestoda**	**Tentaculariidae**	***Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999**	**gill cavity**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Cestoda**	**Tentaculariidae**	***Nybelinia africana* Dollfus, 1960**	**stomach wall**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Crustacea: Copepoda**	**Lernaeopodidae**	***Thysanote* sp.**	**gills**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Digenea**	**Bucephalidae**	***Bucephalus* sp.**	**stomach**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet.**	**inner operculum**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Monogenea**	**(Polyopisthocotylea)**	**Polyopisthocotylea indet.**	**gills**	**Present study**
Perciformes	Sciaenidae	*Pennahia macrocephalus* (Tang, 1937)	Monogenea	Ancyrocephalidae	*Pseudempleurosoma haywardi* Theisen et al., 2017	pharynx	Theisen et al. 2017
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Monogenea**	**Capsalidae**	***Entobdella* sp.**	**gill cavity**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Nematoda**	**Camallanidae**	***Camallanus* sp.**	**intestine**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Nematoda**	**Camallanidae**	***Procamallanus* sp.**	**intestine**	**Present study**
Perciformes	**Sciaenidae**	***Pennahia macrocephalus* (Tang, 1937)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* spp. (two species/morphotypes)**	**body cavity**	**Present study**
Perciformes	Sciaenidae	*Sciaena* sp.	Crustacea: Copepoda	Lernaeopodidae	*Brachiella sciaenophila* (Heller, 1865)	gills	Heller 1865
Perciformes	Sciaenidae	*Sonorolux fluminis* Trewavas, 1977	Nematoda	Philometridae	*Philometra* sp.[37]	gonads	Dewi & Palm 2017
Perciformes	Scombridae	(*Scomberomorus maculatus*) > *S. queenslandicus/guttatus*					
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Acanthocephala	nr	Acanthocephala indet.	mesenteries	Silaban 2012

Perciformes	**Scombridae**	***Auxis r. rochei* (Risso, 1810)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**mesenteries**	**Present study**
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Acanthocephala	Rhadinorhynchidae	*Rhadinorhynchus zhukovi* Golvan, 1969	mesenteries	Kleinertz et al. 2016
Perciformes	**Scombridae**	***Auxis r. rochei* (Risso, 1810)**	**Cestoda**	**Lacistorhynchidae**	***Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931**	**body cavity**	**Present study**
Perciformes	**Scombridae**	***Auxis r. rochei* (Risso, 1810)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* cf. *regalis* v. *infestans***	**gills**	**Present study**
Perciformes	**Scombridae**	***Auxis r. rochei* (Risso, 1810)**	**Digenea**	**nr**	**Digenea indet. spp. (three species/morphotypes)**	**gonads**	**Present study**
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Nematoda	Anisakidae	*Anisakis berlandi* Mattiucci et al., 2014	body cavity	Palm & Theisen et al. 2017
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Nematoda	Anisakidae	*Anisakis pegreffii* Campana-Rouget & Biocca, 1955	body cavity	Palm & Theisen et al. 2017
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Nematoda	Anisakidae	*Anisakis physeteris* (Baylis, 1923)	body cavity	Palm & Theisen et al. 2017
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Ndun 2010
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	body cavity	Kuhn et al. 2013
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	body cavity	Kuhn et al. 2011
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	body cavity	Palm & Theisen et al. 2017
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	body cavity	Palm et al. 2008
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Kuhn et al. 2013
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Kuhn et al. 2011
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm et al. 2008
Perciformes	Scombridae	*Auxis r. rochei* (Risso, 1810)	Nematoda	nr	Nematoda indet. spp. (two species/morphotypes)	body cavity	Palm & Theisen et al. 2017
Perciformes	Scombridae	*Auxis* sp.	Acanthocephala	nr	Acanthocephala indet.	nr	Hariyadi 2006
Perciformes	Scombridae	*Auxis* sp.	Cestoda	nr	Cestoda indet.	nr	Hariyadi 2006
Perciformes	Scombridae	*Auxis* sp.	Cestoda	Pterobothriidae	*Pterobothrium tangoli* (MacCallum, 1921) Dollfus, 1942	peritoneum	MacCallum 1921
Perciformes	Scombridae	*Auxis* sp.	Digenea	nr	Digenea indet.	nr	Hariyadi 2006
Perciformes	Scombridae	*Auxis* sp.	Nematoda	nr	Nematoda indet.	nr	Hariyadi 2006
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**mesenteries**	**Present study**
Perciformes	Scombridae	*Auxis t. thazard* (Lacépède, 1800)	Acanthocephala	Rhadinorhynchidae	*Rhadinorhynchus zhukovi* Golvan, 1969	mesenteries	Kleinertz et al. 2016
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Cestoda**	**Tentaculariidae**	***Tentacularia coryphaenae* Bosc, 1802**	**musculature**	**Present study, workshop Bali**
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* cf. *regalis* v. *infestans***	**gills**	**Present study**
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Digenea**	**(Strigeidae)**	**cf. Strigeidae indet. (as "*Ophiosoma*" sp.)**	**stomach**	**Present study**
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet. spp. (two species)**	**intestine**	**Present study, workshop Bali**
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet. spp. (two species)**	**gills**	**Present study, workshop Bali**
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Digenea**	**Hemiuridae**	***Dinurus* cf. *scombri* Yamaguti, 1934**	**stomach**	**Present study, workshop Bali**
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Digenea**	**Hemiuridae**	**Hemiuridae indet.**	**stomach**	**Present study, workshop Bali**
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Digenea**	**Hirudinellidae**	***Hirudinella* cf. *ventricosa* (Pallas, 1774) Baird, 1853**	**stomach**	**Present study, workshop Bali**
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Monogenea**	**(Polyopisthocotylea)**	**Polyopisthocotylea indet. spp. (four species/morphotypes)**	**gills**	**Present study**
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Monogenea**	**Hexostomatidae**	***Hexostoma keokeo* Yamaguti, 1968**	**gills**	**Present study**
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Myxozoa: Myxosporea**	**nr**	**Myxozoa indet. ("plasmodia")**	**gallbladder**	**Present study, workshop Bali**
Perciformes	Scombridae	*Auxis t. thazard* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Hibur et al. 2016
Perciformes	Scombridae	*Auxis t. thazard* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Ningsi 2010
Perciformes	Scombridae	*Auxis t. thazard* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Saputra 2011
Perciformes	Scombridae	*Auxis t. thazard* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	mesenteries	Anshary 2011

Perciformes	Scombridae	*Auxis t. thazard* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	mesenteries	Anshary et al. 2014
Perciformes	Scombridae	*Auxis t. thazard* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	mesenteries	Palm & Theisen et al. 2017, workshop
Perciformes	Scombridae	*Auxis t. thazard* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	mesenteries	Anshary 2011
Perciformes	Scombridae	*Auxis t. thazard* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	mesenteries	Anshary et al. 2014
Perciformes	Scombridae	*Auxis t. thazard* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	mesenteries	Kuhn et al. 2013
Perciformes	Scombridae	*Auxis t. thazard* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	mesenteries	Kuhn et al. 2011
Perciformes	Scombridae	*Auxis t. thazard* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	mesenteries	Palm & Theisen et al. 2017, workshop
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Nematoda**	**Cystidicolidae**	***Prospinitectus* cf. *mollis* (Mamaev, 1968) Petter, 1979**	**stomach**	**Present study**
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Nematoda**	**Cystidicolidae**	***Spinitectus* sp.**	**stomach**	**Present study, workshop Bali**
Perciformes	**Scombridae**	***Auxis t. thazard* (Lacépède, 1800)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Cestoda	nr	Cestoda indet.	gills	Guanawan 2008
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Crustacea: Copepoda	Bomolochidae	*Unicolax collateralis* Cressey & Cressey, 1980	nostrils	Cressey & Cressey 1980a
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Crustacea: Copepoda	Caligidae	*Caligus regalis* Leigh-Sharpe, 1930	surface	Leigh-Sharpe 1930
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Crustacea: Copepoda	Caligidae	*Caligus* sp.[49]	surface	Guanawan 2008
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Crustacea: Copepoda	Pseudocycnidae	*Pseudocycnus appendiculatus* Heller, 1865	gills	Leigh-Sharpe 1930
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Digenea	Didymozoidae	*Lobatozoum euthynni* (Ching & Madhavi, 1999)	gill sinus	Ching & Madhavi 1999
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Digenea	Didymozoidae	*Lobatozoum yaito* (Yamaguti, 1965) Pozdnyakov, 1989	gill arches	Ching & Madhavi 1999
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Digenea	Lecithasteridae	*Hysterolecitha* sp. (or *Labatozoum* species below?)	gills	Guanawan 2008
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Monogenea	Capsalidae	*Capsala* sp. (cf. *N. melleni* below?)	gills	Guanawan 2008
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Monogenea	Capsalidae	*Neobenedenia melleni* (MacCallum, 1927) Yamaguti, 1963	gills	Hidayati et al. 2016
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1983
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm et al. 2008
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Bahri 2016
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Hidayati et al. 2016
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Ilahude et al. 1978
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Ira 2010
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Nematoda	Anisakidae	*Anisakis typica* (*sensu lato**)	mesenteries	Anshary et al. 2014
Perciformes	Scombridae	*Euthynnus affinis* (Cantor, 1849)	Nematoda	Anisakidae	*Anisakis typica* (*sensu lato**)	mesenteries	Palm & Theisen et al. 2017
Perciformes	Scombridae	*Grammatorcynus bicarinatus* (Quoy & Gaimard, 1825)	Crustacea: Copepoda	Shiinoidae	*Shiinoa occlusa* Kabata, 1968	nostrils	Cressey 1975
Perciformes	Scombridae	*Grammatorcynus bilineatus* (Rüppell, 1836)	Monogenea	Gotocotylidae	*Gotocotyla acanthura* (Parona & Perugia, 1896) Meserve, 1938	gills	Hayward & Rohde 1999a
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Acanthocephala	nr	Acanthocephala indet.	surface (skin)	Sabariah et al. 2014
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	stomach wall	Palm 2004
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Cestoda	Sphyriocephalidae	*Hepatoxylon trichiuri* (Holten, 1802) Bosc, 1811	mouth cavity	Palm 2004
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	musculature	Palm 2000
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	musculature	Palm 2004
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Crustacea: Copepoda	Caligidae	*Caligus* sp.[49]	gills	Sabariah et al. 2014
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Crustacea: Copepoda	Kroyeriidae	*Kroyeria* sp.	gills	Sabariah et al. 2014
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Digenea	Bucephalidae	*Alcicornis* sp.[4]	surface (skin)	Sabariah et al. 2014
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Digenea	Derogenidae	*Derogenes* sp.	surface (skin)	Sabariah et al. 2014
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Digenea	Didymozoidae	Didymozoidae indet.	surface (skin)	Sabariah et al. 2014

Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Digenea	Hemiuridae	*Lecithocladium* sp.	gills	Sabariah et al. 2014
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Myxozoa: Myxosporea	Kudoidae	*Kudoa* sp.	gills	Sabariah et al. 2014
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Hibur et al. 2016
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Soewarlan 2016
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Yani & Susaniati 2017
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	mesenteries	Anshary et al. 2014
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	mesenteries	Palm & Theisen et al. 2017, workshop
Perciformes	Scombridae	*Katsuwonus pelamis* (Linnaeus, 1758)	Nematoda	Philometridae	*Philometra* sp.	gills	Sabariah et al. 2014
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Crustacea: Copepoda	Caligidae	*Caligus* sp.[49]	gills	Mulyanti 2001
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus* cf. *corniger* Yamaguti, 1954		Mulyanti 2001
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Digenea	Hemiuridae	*Lecithochirium* sp.	nr	Indaryanto et al. 2015b
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Digenea	Hemiuridae	*Lecithocladium angustiovum* Yamaguti, 1953	stomach	Indaryanto et al. 2015a
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Digenea	Hemiuridae	*Lecithocladium angustiovum* Yamaguti, 1953	stomach	Indaryanto et al. 2015b
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Digenea	Hemiuridae	*Lecithocladium angustiovum* Yamaguti, 1953	stomach	Mulyanti 2001
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Digenea	Lepocreadiidae	*Prodistomum* sp.[17]	pyloric caeca	Indaryanto et al. 2015b
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Monogenea	(Monopisthocotylea)	*Dactylogyrus/Gyrodactylus*[25]	gills	Mulyanti 2001
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Monogenea	Mazocraeidae	*Kuhnia* cf. *scombri* (Kuhn, 1829) Sproston, 1945 as *Mazocraes* sp.	gills	Mulyanti 2001
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Ilahude 1980
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Ilahude et al. 1978
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Indaryanto et al. 2015b
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm & Theisen et al. 2017
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Palm et al. 2008
Perciformes	Scombridae	*Rastrelliger brachysoma* (Bleeker, 1851)	Nematoda	Camallanidae	*Camallanus* sp.	stomach	Mulyanti 2001
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Crustacea: Copepoda	Bomolochidae	*Pumiliopes jonesi* (Bennet, 1967)	eye ("orbit")	Cressey & Cressey 1980a
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Digenea	Hemiuridae	*Lecithochirium* sp.	nr	Indaryanto et al. 2015b
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Digenea	Hemiuridae	*Lecithocladium angustiovum* Yamaguti, 1953	stomach	Indaryanto et al. 2015b
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Digenea	Hemiuridae	*Lecithocladium angustiovum* Yamaguti, 1953	stomach	Yamaguti 1953b
Perciformes	**Scombridae**	***Rastrelliger kanagurta* (Cuvier, 1816)**	**Digenea**	**Hemiuridae**	***Lecithocladium angustiovum* Yamaguti, 1953**	**stomach**	**Present study**
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Digenea	Hemiuridae	*Lecithocladium parviovum* Yamaguti, 1953	stomach	Yamaguti 1953b
Perciformes	**Scombridae**	***Rastrelliger kanagurta* (Cuvier, 1816)**	**Digenea**	**Hemiuridae**	***Lecithocladium parviovum* Yamaguti, 1953**	**stomach**	**Present study**
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Digenea	Hemiuridae	*Lecithocladium* sp. 1[15]	stomach	Falacy 2013
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Digenea	Hemiuridae	*Lecithocladium* sp. 2[15]	stomach	Falacy 2013
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Digenea	Lepocreadiidae	*Prodistomum orientale* (Layman, 1930) Bray & Gibson, 1990	intestine	Yamaguti 1953b
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Digenea	Lepocreadiidae	*Prodistomum* sp.[17]	intestine	Indaryanto et al. 2015b
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Monogenea	Mazocraeidae	*Kuhnia scombri* (Kuhn, 1829) Sproston, 1945	intestine	Yamaguti 1953a
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	Anisakidae indet.	nr	Burhanuddin & Djamali 1983
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Anshary 2011
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Hadidjaja et al. 1978
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Hutomo et al. 1978
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Martosewojo 1980

Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Palm & Theisen et al. 2017
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Palm et al. 2008
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Utami 2014
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	*Anisakis typica* (*sensu lato* *)	mesenteries	Anshary 2011
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	*Anisakis typica* (*sensu lato* *)	mesenteries	Anshary et al. 2014
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	*Anisakis typica* (*sensu lato* *)	mesenteries	Palm & Theisen et al. 2017
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Hadidjaja et al. 1978
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Hutomo et al. 1978
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Anisakidae	*Terranova* sp.	body cavity	Martosewojo 1980
Perciformes	Scombridae	*Rastrelliger kanagurta* (Cuvier, 1816)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	stomach	Falacy 2013
Perciformes	**Scombridae**	***Rastrelliger kanagurta* (Cuvier, 1816)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**stomach**	**Present study**
Perciformes	Scombridae	*Rastrelliger* sp. (= *Scomber* sp. in Heller 1865)	Crustacea: Copepoda	Caligidae	*Caligus infestans* Heller, 1865	gills	Heller 1865
Perciformes	Scombridae	*Rastrelliger* sp. (= *Scomber* sp. in Heller 1865)	Nematoda	Anisakidae	Anisakidae (indet.) spp.[28]	guts	Baladin 2007
Perciformes	Scombridae	*Rastrelliger* sp. (= *Scomber* sp. in Heller 1865)	Nematoda	Camallanidae	*Anisakis simplex*[31] (Rudolphi, 1809)	guts	Baladin 2007
Perciformes	**Scombridae**	***Sarda orientalis* (Temminck & Schlegel, 1844)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* cf. *infestans* Heller, 1865**	**gills**	**Present study**
Perciformes	**Scombridae**	***Sarda orientalis* (Temminck & Schlegel, 1844)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* cf. *regalis* Leigh-Sharpe, 1930**	**gills**	**Present study**
Perciformes	**Scombridae**	***Sarda orientalis* (Temminck & Schlegel, 1844)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet.**	**intestine**	**Present study**
Perciformes	**Scombridae**	***Sarda orientalis* (Temminck & Schlegel, 1844)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet.**	**gills**	**Present study**
Perciformes	**Scombridae**	***Sarda orientalis* (Temminck & Schlegel, 1844)**	**Digenea**	**nr**	**Digenea indet.**	**body cavity**	**Present study**
Perciformes	**Scombridae**	***Sarda orientalis* (Temminck & Schlegel, 1844)**	**Nematoda**	**Camallanidae**	***Camallanus* sp.**	**pyloric caeca**	**Present study**
Perciformes	**Scombridae**	***Sarda orientalis* (Temminck & Schlegel, 1844)**	**Nematoda**	**Cystidicolidae**	***Prospinitectus* cf. *mollis* (Mamaev, 1968) Petter, 1979**	**stomach**	**Present study**
Perciformes	Scombridae	*Scomber japonicus* Houttuyn, 1782	Cestoda	Pterobothriidae	*Pterobothrium tangoli* (MacCallum, 1921) Dolfus, 1942	peritoneum	Palm 2004
Perciformes	**Scombridae**	***Scomberomorus commerson* (Lacépède, 1800)**	**Cestoda**	**Lacistorhynchidae**	***Callitetrarhynchus* cf. *speciosus* (Linton, 1897) Carvajal & Rego, 1985**	**body cavity**	**Present study, workshop Bali**
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Latama 2006
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Lester et al. 2001
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	stomach wall	Palm 2004
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Cestoda	Lacistorhynchidae	*Grillotiella exilis* (Linton, 1909) Palm, 2004	stomach	Latama 2006
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Cestoda	Lacistorhynchidae	*Grillotiella exilis* (Linton, 1909) Palm, 2004	stomach	Lester et al. 2001
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Cestoda	Lacistorhynchidae	*Grillotiella exilis* (Linton, 1909) Palm, 2004	gills	Palm 2004
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Cestoda	Otobothriidae	*Otobothrium cysticum* (Mayer, 1842)	stomach	Lester et al. 2001
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Cestoda	Pterobothriidae	*Pterobothrium* sp.	stomach	Lester et al. 2001
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Cestoda	Pterobothriidae	*Pterobothrium* sp.	stomach	Palm 2004
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Crustacea: Copepoda	Bomolochidae	*Unicolax ciliatus* Cressey & Cressey, 1980	nr	Cressey & Cressey 1980a
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Crustacea: Copepoda	Caligidae	*Caligus asymmetricus* Kabata, 1965	gills	Cressey & Cressey 1980a
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Crustacea: Copepoda	Caligidae	*Caligus infestans* Heller, 1865	gills	Cressey & Cressey 1980a
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Crustacea: Copepoda	Pseudocycnidae	*Cybicola armatus* (Bassett-Smith, 1898)	gills	Latama 2006
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Crustacea: Copepoda	Pseudocycnidae	*Cybicola armatus* (Bassett-Smith, 1898)	gills	Lester et al. 2001
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Digenea	Didymozoidae	Didymozoidae indet. (as *Didymozoon* sp.)	gills	Latama 2006
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Gotocotylidae	*Cathucotyle cathuaui* Lebedev, 1968	gills	Hayward & Rohde 1999a
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Gotocotylidae	*Cathucotyle filipinensis* Hayward & Rohde, 1999	gills	Hayward & Rohde 1999a

Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Gotocotylidae	*Gotocotyla acanthura* (Parona & Perugia, 1896) Meserve, 1938	gills	Hayward & Rohde 1999a
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Gotocotylidae	*Gotocotyla acanthura* (Parona & Perugia, 1896) Meserve, 1938	gills	Latama 2006
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Gotocotylidae	*Gotocotyla acanthura* (Parona & Perugia, 1896) Meserve, 1938	gills	Lester et al. 2001
Perciformes	**Scombridae**	***Scomberomorus commerson* (Lacépède, 1800)**	**Monogenea**	**Gotocotylidae**	***Gotocotyla acanthura* (Parona & Perugia, 1896) Meserve, 1938**	**gills**	**Present study, workshop Bali**
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Gotocotylidae	*Gotocotyla bivaginalis* (Ramalingham, 1961) Rohde, 1976	gills	Hayward & Rohde 1999a
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Gotocotylidae	*Gotocotyla bivaginalis* (Ramalingham, 1961) Rohde, 1976	gills	Lester et al. 2001
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Gotocotylidae	*Gotocotyla heapae* Hayward & Rohde, 1999	gills	Hayward & Rohde 1999a
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Microcotylidae	*Bivagina alcedinis* (Parona & Perugia, 1889)	gills	Latama 2006
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Microcotylidae	*Bivagina australis taxon inquirendum, nomen dubium*	gills	Latama 2006
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Microcotylidae	*Microcotyle* sp.	gills	Latama 2006
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Thoracocotylidae	*Pricea multae* Chauhan, 1945	gills	Latama 2006
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Thoracocotylidae	*Pricea multae* Chauhan, 1945	gills	Lester et al. 2001
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Thoracocotylidae	*Pricea multae* Chauhan, 1945	gills	Rohde & Hayward 1999
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Thoracocotylidae	*Pseudothoracocotyla ovalis* (Tripathi, 1956) Yamaguti, 1963	gills	Hayward & Rohde 1999a
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Thoracocotylidae	*Pseudothoracocotyla ovalis* (Tripathi, 1956) Yamaguti, 1963	gills	Latama 2006
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Monogenea	Thoracocotylidae	*Pseudothoracocotyla ovalis* (Tripathi, 1956) Yamaguti, 1963	gills	Lester et al. 2001
Perciformes	**Scombridae**	***Scomberomorus commerson* (Lacépède, 1800)**	**Myxozoa: Myxosporea**	**Kudoidae**	***Kudoa* sp.**	**musculature**	**Present study, workshop Bali**
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Nematoda	Anisakidae	Anisakidae indet.	nr	Burhanuddin & Djamali 1983
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Latama 2006
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Palm & Theisen et al. 2017
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Palm et al. 2008
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Nematoda	Anisakidae	*Anisakis* sp.[30] (as *A. simplex* see annotations)	mesenteries	Lester et al. 2001
Perciformes	Scombridae	*Scomberomorus commerson* (Lacépède, 1800)	Nematoda	Anisakidae	*Terranova* sp.	stomach wall	Lester et al. 2001
Perciformes	Scombridae	*Scomberomorus guttatus* (Bloch & Schneider, 1801)	Crustacea: Copepoda	Bomolochidae	*Unicolax ciliatus* Cressey & Cressey, 1980	nr	Cressey & Cressey 1980a
Perciformes	Scombridae	*Scomberomorus guttatus* (Bloch & Schneider, 1801)	Crustacea: Copepoda	Pseudocycnidae	*Cybicola armatus* (Bassett-Smith, 1898)	nr	Cressey & Cressey 1980a
Perciformes	Scombridae	*Scomberomorus guttatus* (Bloch & Schneider, 1801)	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	gonads	Koinari et al. 2013
Perciformes	Scombridae	*Scomberomorus guttatus* (Bloch & Schneider, 1801)	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	gonads	Palm & Theisen et al. 2017, workshop
Perciformes	Scombridae	*Scomberomorus koreanus* (Kishinouye, 1915)	Crustacea: Copepoda	Caligidae	*Caligus cybii* Bassett-Smith, 1898	gills	Cressey & Cressey 1980a
Perciformes	Scombridae	*Scomberomorus koreanus* (Kishinouye, 1915)	Crustacea: Copepoda	Pseudocycnidae	*Cybicola armatus* (Bassett-Smith, 1898)	nr	Cressey & Cressey 1980a
Perciformes	Scombridae	*Scomberomorus lineolatus* (Cuvier, 1829)	Monogenea	Thoracocotylidae	*Pricea multae* Chauhan, 1945	gills	Rohde & Hayward 1999
Perciformes	Scombridae	*Scomberomorus multiradiatus* Munro, 1964	Monogenea	Thoracocotylidae	*Pseudothoracocotyla ovalis* (Tripathi, 1956) Yamaguti, 1963	gills	Hayward & Rohde 1999b
Perciformes	Scombridae	*Scomberomorus queenslandicus* Munro, 1943	Crustacea: Copepoda	Caligidae	*Caligus biseriodentatus* Shen, 1957	gills	Cressey & Cressey 1980a
Perciformes	Scombridae	*Scomberomorus queenslandicus* Munro, 1943	Monogenea	Gotocotylidae	*Gotocotyla queenslandici* Hayward & Rohde, 1999	gills	Hayward & Rohde 1999a
Perciformes	Scombridae	*Scomberomorus queenslandicus* Munro, 1943	Monogenea	Thoracocotylidae	*Pseudothoracocotyla ovalis* (Tripathi, 1956) Yamaguti, 1963	gills	Hayward & Rohde 1999b
Perciformes	Scombridae	*Scomberomorus queenslandicus* Munro, 1943	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	gonads	Koinari et al. 2013
Perciformes	Scombridae	*Scomberomorus queenslandicus* Munro, 1943	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	gonads	Palm & Theisen et al. 2017, workshop
Perciformes	Scombridae	*Scomberomorus* sp.	Crustacea: Isopoda	Cymothoidae	*Cymothoa truncata* Schiødte & Meinert, 1884	gills	Nierstrasz 1931
Perciformes	Scombridae	*Scomberomorus* sp.	Crustacea: Isopoda	Cymothoidae	*Cymothoa truncata* Schiødte & Meinert, 1884	gills	Sidabalok 2013
Perciformes	Scombridae	*Scomberomorus* sp.	Crustacea: Isopoda	Cymothoidae	*Cymothoa truncata* Schiødte & Meinert, 1884	gills	Trilles 1979

Perciformes	Scombridae	*Scomberomorus* sp.	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Utami 2014
Perciformes	**Scombridae**	***Thunnus albacares* (Bonnaterre, 1788)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**body cavity**	**Present study, workshop Bali**
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Acanthocephala	Polymorphidae	*Bolbosoma* sp.	stomach wall	Lestari et al. 2016
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Acanthocephala	Rhadinorhynchidae	*Rhadinorhynchus* sp.[48]	stomach wall	Lestari et al. 2016
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Palm 2004
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Cestoda	Lacistorhynchidae	*Dasyrhynchus talismani* Dollfus, 1935	liver	Palm 2004
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Cestoda	nr	Cestoda indet.	gills	Sabariah et al. 2014
Perciformes	**Scombridae**	***Thunnus albacares* (Bonnaterre, 1788)**	**Cestoda**	**nr**	**Cestoda indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Scombridae**	***Thunnus albacares* (Bonnaterre, 1788)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus productus* Dana, 1852**	**gills**	**Present study, workshop Bali**
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Crustacea: Copepoda	Caligidae	*Caligus* sp.[51]	gills	Sabariah et al. 2014
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Crustacea: Copepoda	Kroyeriidae	*Kroyeria* sp.	gills	Sabariah et al. 2014
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Digenea	Didymozoidae	Didimozoidae indet. spp. (two species)	**kidney/skin**	Sabariah et al. 2014
Perciformes	**Scombridae**	***Thunnus albacares* (Bonnaterre, 1788)**	**Digenea**	**Didymozoidae**	**Didimozoidae indet. spp. (two species)**	**kidney/skin**	**Present study, workshop Bali**
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Digenea	Didymozoidae	*Didymodiclinus* sp.[7]	gills	Lestari et al. 2016
Perciformes	**Scombridae**	***Thunnus albacares* (Bonnaterre, 1788)**	**Digenea**	**Didymozoidae**	***Didymosulcus philobranchia* (Yamaguti, 1970) Pozdnyakov, 1990**	**gills**	**Present study, workshop Bali**
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Digenea	Didymozoidae	*Didymosulcus* sp.[8]	gills	Lestari et al. 2016
Perciformes	**Scombridae**	***Thunnus albacares* (Bonnaterre, 1788)**	**Digenea**	**Didymozoidae**	***Koellikeria orientalis* Yamaguti, 1934**	**stomach**	**Present study, workshop Bali**
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Digenea	Didymozoidae	*Koellikeria* sp.[9]	stomach wall	Lestari et al. 2016
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Digenea	Hirudinellidae	*Hirudinella ventricosa* (Pallas, 1774) Baird, 1853	stomach	Lestari et al. 2016
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Monogenea	Monocotylidae	*Monocotyle* sp.	gills	Sabariah et al. 2014
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Yani & Susaniati 2017
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Koinari et al. 2013
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017
Perciformes	Scombridae	*Thunnus albacares* (Bonnaterre, 1788)	Nematoda	Philometridae	*Philometra* sp.	gills	Sabariah et al. 2014
Perciformes	Scombridae	*Thunnus obesus* (Lowe, 1839)	Acanthocephala	Polymorphidae	*Bolbosoma* sp.	stomach wall	Lestari et al. 2016
Perciformes	Scombridae	*Thunnus obesus* (Lowe, 1839)	Acanthocephala	Rhadinorhynchidae	*Rhadinorhynchus* sp.[48]	stomach wall	Lestari et al. 2016
Perciformes	Scombridae	*Thunnus obesus* (Lowe, 1839)	Cestoda	Lacistorhynchidae	*Dasyrhynchus talismani* Dollfus, 1935	musculature	Palm 2004
Perciformes	Scombridae	*Thunnus obesus* (Lowe, 1839)	Digenea	Didymozoidae	*Didymodiclinus* sp.[7]	gills	Lestari et al. 2016
Perciformes	Scombridae	*Thunnus obesus* (Lowe, 1839)	Digenea	Didymozoidae	*Didymosulcus* sp.[8]	gills	Lestari et al. 2016
Perciformes	Scombridae	*Thunnus obesus* (Lowe, 1839)	Digenea	Didymozoidae	*Koellikeria* spp.[9]	stomach/(wall)	Lestari et al. 2016
Perciformes	Scombridae	*Thunnus obesus* (Lowe, 1839)	Digenea	Hirudinellidae	*Hirudinella ventricosa* (Pallas, 1774) Baird, 1853	stomach	Lestari et al. 2016
Perciformes	Serranidae	(*Epinephelus summana*) > *E. coeruleopunctatus/ongus*					
Perciformes	Serranidae	*Aethaloperca rogaa* (Forsskål, 1775)	Crustacea: Copepoda	Caligidae	*Caligus* spp.[52]	gills	Stolz 2017
Perciformes	Serranidae	*Aethaloperca rogaa* (Forsskål, 1775)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia* cf. *cadenati* Nuñes-Ruivo, 1954	gills	Stolz 2017
Perciformes	Serranidae	*Aethaloperca rogaa* (Forsskål, 1775)	Crustacea: Copepoda	nr	Copepoda indet.	gills	Stolz 2017
Perciformes	Serranidae	*Aethaloperca rogaa* (Forsskål, 1775)	Crustacea: Copepoda	Pennellidae	Pennellidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Aethaloperca rogaa* (Forsskål, 1775)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Anyperodon leucogrammicus* (Valenciennes, 1828)	Crustacea: Copepoda	Caligidae	*Caligus* spp.[52]	gills	Stolz 2017
Perciformes	Serranidae	*Anyperodon leucogrammicus* (Valenciennes, 1828)	Crustacea: Copepoda	Caligidae	*Lepeophtheirus perpes* Leigh-Sharpe, 1934	nr	Leigh-Sharpe 1934

Perciformes	Serranidae	*Anyperodon leucogrammicus* (Valenciennes, 1828)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia* cf. *cadenati* Nuñes-Ruivo, 1954	gills	Stolz 2017
Perciformes	Serranidae	*Anyperodon leucogrammicus* (Valenciennes, 1828)	Crustacea: Copepoda	Lernanthropidae	*Sagum epinepheli* (Yamaguti & Yamasu, 1960)	gills	Stolz 2017
Perciformes	Serranidae	*Anyperodon leucogrammicus* (Valenciennes, 1828)	Crustacea: Copepoda	nr	Copepoda indet.	gills	Stolz 2017
Perciformes	Serranidae	*Anyperodon leucogrammicus* (Valenciennes, 1828)	Crustacea: Copepoda	Pennellidae	Pennellidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Anyperodon leucogrammicus* (Valenciennes, 1828)	Crustacea: Iopoda	(Cymothooidea)	Cymothooidea indet.	gills	Stolz 2017
Perciformes	Serranidae	*Anyperodon leucogrammicus* (Valenciennes, 1828)	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Stolz 2017
Perciformes	Serranidae	*Anyperodon leucogrammicus* (Valenciennes, 1828)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Stolz 2017
Perciformes	**Serranidae**	***Anyperodon leucogrammicus* (Valenciennes, 1828)**	**Digenea**	**Hemiuridae**	***Qadriana* cf. *fusiformis* Bilqees, 1971**	**stomach**	**Present study**
Perciformes	Serranidae	*Anyperodon leucogrammicus* (Valenciennes, 1828)	Monogenea	Diplectanidae	*Pseudorhabdosynochus* spp.[27]	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis argus* Schneider, 1801	Crustacea: Copepoda	Caligidae	*Caligus* spp.[52]	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis argus* Schneider, 1801	Crustacea: Copepoda	nr	Copepoda indet.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis argus* Schneider, 1801	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis argus* Schneider, 1801	Crustacea: Isopoda	Corallanidae	Corrallanidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis argus* Schneider, 1801	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis argus* Schneider, 1801	Monogenea	Ancyrocephalidae	*Haliotrema* sp.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis cyanostigma* (Valenciennes, 1828)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *acanthopagri* Lin, Ho & Chen, 1994	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis cyanostigma* (Valenciennes, 1828)	Crustacea: Copepoda	Caligidae	*Caligus* spp.[52]	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis cyanostigma* (Valenciennes, 1828)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia* cf. *cadenati* Nuñes-Ruivo, 1954	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis cyanostigma* (Valenciennes, 1828)	Crustacea: Copepoda	nr	Copepoda indet.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis cyanostigma* (Valenciennes, 1828)	Crustacea: Copepoda	Pennellidae	Pennellidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis cyanostigma* (Valenciennes, 1828)	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis cyanostigma* (Valenciennes, 1828)	Crustacea: Isopoda	Corallanidae	Corrallanidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis cyanostigma* (Valenciennes, 1828)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis cyanostigma* (Valenciennes, 1828)	Nematoda	Anisakidae	*Anisakis typica* (*sensu lato* *)	mesenteries	Anshary et al. 2014
Perciformes	Serranidae	*Cephalopholis cyanostigma* (Valenciennes, 1828)	Nematoda	Philometridae	*Philometra* sp.	gonads	Dewi & Palm 2017
Perciformes	Serranidae	*Cephalopholis cyanostigma* (Valenciennes, 1828)	Nematoda	Philometridae	*Philometra* sp.	gonads	Stolz 2017
Perciformes	**Serranidae**	***Cephalopholis igarashiensis* Katayama, 1957**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Cephalopholis igarashiensis* Katayama, 1957**	**Crustacea: Copepoda**	**Hatschekiidae**	***Hatschekia* cf. *cadenati* Nuñes-Ruivo, 1954**	**gills**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Cephalopholis igarashiensis* Katayama, 1957**	**Digenea**	**Bucephalidae**	***Prosorhynchus* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Cephalopholis igarashiensis* Katayama, 1957**	**Monogenea**	**Capsalidae**	**Capsalidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Cephalopholis igarashiensis* Katayama, 1957**	**Nematoda**	**Anisakidae**	***Anisakis* sp.[30]**	**mesenteries**	**Present study**
Perciformes	**Serranidae**	***Cephalopholis igarashiensis* Katayama, 1957**	**Nematoda**	**Cucullanidae**	***Cucullanus* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	Serranidae	*Cephalopholis leopardus* (Lacepède, 1801)	Digenea	Opecoelidae	*Allopodocotyle serrani* Yamaguti, 1952	pyloric caeca	Yamaguti 1952
Perciformes	Serranidae	*Cephalopholis leopardus* (Lacepède, 1801)	Monogenea	Diplectanidae	*Pseudorhabdosynochus serrani* (Yamaguti, 1953) Kritski & Beverly-Burton, 1986	gills	Yamaguti 1953a
Perciformes	Serranidae	*Cephalopholis miniata* (Forsskål, 1775)	Crustacea: Copepoda	Caligidae	*Caligus* spp.[52]	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis miniata* (Forsskål, 1775)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia* cf. *cadenati* Nuñes-Ruivo, 1954	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis miniata* (Forsskål, 1775)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus* sp. nov. 1	gill cavity	Stolz 2017
Perciformes	Serranidae	*Cephalopholis miniata* (Forsskål, 1775)	Crustacea: Copepoda	nr	Copepoda indet.	gills	Stolz 2017

Perciformes	Serranidae	*Cephalopholis miniata* (Forsskål, 1775)	Crustacea: Copepoda	Pennellidae	Pennellidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis miniata* (Forsskål, 1775)	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis miniata* (Forsskål, 1775)	Crustacea: Isopoda	Corallanidae	Corrallanidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis miniata* (Forsskål, 1775)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis miniata* (Forsskål, 1775)	Digenea	Didymozoidae	*Didymodiclinus* cf. *epinepheli*[7] (Abdul-Salam et al., 1990) Pozdnyakov, 1994	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis miniata* (Forsskål, 1775)	Monogenea	Ancyrocephalidae	*Haliotrema* sp.	gills	Stolz 2017
Perciformes	Serranidae	*Cephalopholis miniata* (Forsskål, 1775)	Monogenea	Dactylogyridae	Dactylogyridae indet.	gills	Stolz 2017
Perciformes	**Serranidae**	***Cephalopholis sexmaculata* (Rüppell, 1830)**	**Nematoda**	**Anisakidae**	***Anisakis* sp.**[30]	**mesenteries**	**Present study**
Perciformes	Serranidae	*Cephalopholis sexmaculata* (Rüppell, 1830)	Nematoda	Philometridae	*Philometra* sp.	mouth cavity	Dewi & Palm 2017
Perciformes	Serranidae	*Cephalopholis sexmaculata* (Rüppell, 1830)	Nematoda	Philometridae	*Philometra* sp.	mouth cavity	Stolz 2017
Perciformes	**Serranidae**	***Epinephelus areolatus* (Forsskål, 1775)**	**Acanthocephala**	**Isthmosacanthidae**	***Gorgorhynchoides* cf. *epinepheli* Wang Pu-qin, 1980**	**mesenteries**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Acanthocephala	Polymorphidae	*Southwellina hispida* (Van Cleave, 1925)	mesenteries	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Acanthocephala	Polymorphidae	*Southwellina hispida* (Van Cleave, 1925)	mesenteries	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	mesenteries	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	mesenteries	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Cestoda	nr	Cestoda indet.	stomach	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Cestoda	nr	Cestoda indet.	stomach	Kleinertz et al. 2012/2014
Perciformes	**Serranidae**	***Epinephelus areolatus* (Forsskål, 1775)**	**Cestoda**	**Otobothriidae**	***Otobothrium* sp.**	**eye cavity**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	stomach wall	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	stomach wall	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *epinepheli* Yamaguti, 1936	operculum	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *epinepheli* Yamaguti, 1936	operculum	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia* sp.[53]	gills	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia* sp.[53]	gills	Kleinertz et al. 2012/2014
Perciformes	**Serranidae**	***Epinephelus areolatus* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Lernaeopodidae**	***Thysanote* sp.**	**inner operculum**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Copepoda	nr	Copepoda indet.	mouth tissue	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Copepoda	nr	Copepoda indet.	mouth tissue	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Copepoda	Pennellidae	Pennellidae indet.	gills	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Copepoda	Pennellidae	Pennellidae indet.	gills	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Iopoda	(Cymothooidea)	Cymothooidea indet.	gills	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Iopoda	(Cymothooidea)	Cymothooidea indet.	gills	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Kleinertz et al. 2012/2014
Perciformes	**Serranidae**	***Epinephelus areolatus* (Forsskål, 1775)**	**Digenea**	**Bucephalidae**	***Prosorhynchus* sp. (1 v. 2?)**	**pyloric caeca**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 1	intestine	Bray et al. 2018
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 1	intestine	Kleinertz 2010

Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 1	intestine	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	intestine	Bray et al. 2018
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	intestine	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	intestine	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Digenea	Didymozoidae	*Didymodiclinus* sp.[7]	gills	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Digenea	Didymozoidae	*Didymodiclinus* sp.[7]	gills	Kleinertz et al. 2012/2014
Perciformes	**Serranidae**	***Epinephelus areolatus* (Forsskål, 1775)**	**Digenea**	**Didymozoidae**	***Didymodiclinus* sp.[7]**	**inner operculum**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Epinephelus areolatus* (Forsskål, 1775)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet. spp. (two species)**	**eye cavity/fin**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Digenea	Hemiuridae	*Lecithochirium magnaporum* Manter 1940	stomach	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Digenea	Hemiuridae	*Lecithochirium magnaporum* Manter 1940	stomach	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Digenea	Opecoelidae	*Allopodocotyle* cf. *epinepheli* (Yamaguti, 1942) Pritchard, 1966	intestine	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Digenea	Opecoelidae	*Allopodocotyle* cf. *epinepheli* (Yamaguti, 1942) Pritchard, 1966	intestine	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Microsporea	nr	Microsporea indet.	mesenteries	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Microsporea	nr	Microsporea indet.	mesenteries	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Monogenea	Diplectanidae	*Pseudorhabdosynochus* spp.[27]	gills	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Monogenea	Diplectanidae	*Pseudorhabdosynochus* spp.[27]	gills	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Nematoda	Anisakidae	*Anisakis* sp. "HC-2005"	mesenteries	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Nematoda	Anisakidae	*Anisakis* sp. "HC-2005"	mesenteries	Palm & Theisen et al. 2017
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm et al. 2008
Perciformes	**Serranidae**	***Epinephelus areolatus* (Forsskål, 1775)**	**Nematoda**	**Anisakidae**	***Terranova* sp.**	**body cavity**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Epinephelus areolatus* (Forsskål, 1775)**	**Nematoda**	**Capillariidae**	***Capillaria* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Nematoda	Philometridae	*Philometra* sp.	guts	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Nematoda	Philometridae	*Philometra* sp.	guts	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	guts	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus areolatus* (Forsskål, 1775)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	guts	Kleinertz et al. 2012/2014
Perciformes	**Serranidae**	***Epinephelus* cf. *polyphekadion* var. hybrid**	**Digenea**	**Aporocotylidae**	**Aporocotylidae indet.**	**heart**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Epinephelus* cf. *polyphekadion* var. hybrid**	**Digenea**	**nr**	**Bucephalidae (or Monorchiidae?) indet.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Epinephelus* cf. *polyphekadion* var. hybrid**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus coeruleopunctatus* (Bloch, 1790)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Muthmainnah 2004
Perciformes	Serranidae	*Epinephelus coeruleopunctatus* (Bloch, 1790)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Slade 2001
Perciformes	**Serranidae**	***Epinephelus coeruleopunctatus* (Bloch, 1790)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Epinephelus coeruleopunctatus* (Bloch, 1790)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus coeruleopunctatus* (Bloch, 1790)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1983
Perciformes	Serranidae	*Epinephelus coeruleopunctatus* (Bloch, 1790)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm & Theisen et al. 2017
Perciformes	Serranidae	*Epinephelus coeruleopunctatus* (Bloch, 1790)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm et al. 2008
Perciformes	Serranidae	*Epinephelus coeruleopunctatus* (Bloch, 1790)	Nematoda	Philometridae	*Philometra* sp.	gonads	Dewi & Palm 2017
Perciformes	Serranidae	*Epinephelus coeruleopunctatus* (Bloch, 1790)	Nematoda	Philometridae	*Philometra* sp.	gonads	Stolz 2017
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Acanthocephala	Isthmosacanthidae	*Gorgorhynchoides golvani* (Chandra et al., 1984) Bhattacharya, 2007	nr	Neubert et al. 2016b

Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Acanthocephala	Polymorphidae	*Southwellina hispida* (Van Cleave, 1925)	mesenteries	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Acanthocephala	Polymorphidae	*Southwellina hispida* (Van Cleave, 1925)	mesenteries	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Acanthocephala	Polymorphidae	*Southwellina hispida* (Van Cleave, 1925)	mesenteries	Verweyen et al. 2011
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Acanthocephala	Rhadinorhynchidae	*Rhadinorhynchus* sp.	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	gonads	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	Bothriocephalidae	*Bothriocephalus* sp.	stomach	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	Bothriocephalidae	*Bothriocephalus* sp.	stomach	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	Bothriocephalidae	*Bothriocephalus* sp.	stomach	Palm & Rückert 2009
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	Bothriocephalidae	*Bothriocephalus* sp.	stomach	Yuniar 2005
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	nr	Cestoda indet.	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	stomach	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	stomach	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	stomach wall	Palm 2004
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp.	surface	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp.	surface	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp.	surface	Muthmainnah 2004
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp.	surface	Palm & Rückert 2009
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp.	surface	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp.	surface	Yuniar 2005
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp. (5 spp.)	surface	Slade 2001
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *acanthopagri* Lin, Ho & Chen, 1994	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *epinepheli* Yamaguti, 1936	gills	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *epinepheli* Yamaguti, 1936	gills	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *epinepheli* Yamaguti, 1936	gills	Yuniar 2005
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *epinepheli* Yamaguti, 1936	gills	Yuniar et al. 2007
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Caligidae	*Caligus* spp.[52]	gills	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Caligidae	*Caligus* spp.[52]	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia cernae* Goggio, 1905	gills	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia* sp.[53]	gills	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Hatschekiidae	*Hatschekia* sp.[53]	gills	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Lernanthropidae	*Sagum epinepheli* (Yamaguti & Yamasu, 1960)	gills	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Lernanthropidae	*Sagum epinepheli* (Yamaguti & Yamasu, 1960)	gills	Kleinertz 2010

Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Lernanthropidae	*Sagum epinepheli* (Yamaguti & Yamasu, 1960)	gills	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Lernanthropidae	*Sagum epinepheli* (Yamaguti & Yamasu, 1960)	gills	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	nr	Copepoda indet.	gills	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	nr	Copepoda indet.	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Pennellidae	Pennellidae indet. spp (three species)	gills	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Pennellidae	Pennellidae indet. spp (three species)	gills	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Pennellidae	Pennellidae indet. spp (three species)	gills	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Pennellidae	Pennellidae indet. spp (three species)	gills	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Pennellidae	Pennellidae indet. spp (three species)	gills	Yuniar 2005
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Copepoda	Pennellidae	Pennellidae indet. spp (three species)	gills	Yuniar et al. 2007
Perciformes	**Serranidae**	***Epinephelus coioides* (Hamilton, 1822)**	**Crustacea: Iopoda**	**(Cymothooidea)**	**Cymothooidea indet.**	**gills**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Isopoda	Corallanidae	*Argathona rhinoceros* (Bleeker, 1960)	gill cavity	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Isopoda	Corallanidae	*Argathona rhinoceros* (Bleeker, 1960)	gill cavity	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Isopoda	Corallanidae	*Argathona rhinoceros* (Bleeker, 1960)	gill cavity	Stolz 2017
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Acanthocolpidae	*Stephanostomum* sp.	nr	Neubert et al. 2016b
Perciformes	**Serranidae**	***Epinephelus coioides* (Hamilton, 1822)**	**Digenea**	**Aporocotylidae**	**Aporocotylidae indet.**	**heart**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus luzonicus* Velasques, 1959	intestine	Bray et al. 2018
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus luzonicus* Velasques, 1959	intestine	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus luzonicus* Velasques, 1959	intestine	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus luzonicus* Velasques, 1959	intestine	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus luzonicus* Velasques, 1959	intestine	Palm & Rückert 2009
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus luzonicus* Velasques, 1959	intestine	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus luzonicus* Velasques, 1959	intestine	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. (1 v. 2?)	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. (1 v. 2?)	pyloric caeca	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. (1 v. 2?)	pyloric caeca	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. 1	intestine	Bray et al. 2018
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. 1	intestine	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. 1	intestine	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. 1	intestine	Palm & Rückert 2009

Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. 1	intestine	Yuniar 2005
Perciformes	**Serranidae**	***Epinephelus coioides* (Hamilton, 1822)**	**Digenea**	**Bucephalidae**	***Prosorhynchus* sp. 1**	**intestine**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	intestine	Bray et al. 2018
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	intestine	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	intestine	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	intestine	Rückert et al. 2009b
Perciformes	**Serranidae**	***Epinephelus coioides* (Hamilton, 1822)**	**Digenea**	**Bucephalidae**	***Prosorhynchus* sp. 2**	**intestine**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	pyloric caeca	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	pyloric caeca	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Didymozoidae	*Allonematobothrium epinepheli* Yamaguti, 1965	inner operculum	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Didymozoidae	*Allonematobothrium epinepheli* Yamaguti, 1965	inner operculum	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Didymozoidae	*Allonematobothrium epinepheli* Yamaguti, 1965	inner operculum	Kleinertz et al. 2012/2014
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Didymozoidae	*Allonematobothrium epinepheli* Yamaguti, 1965	nr	Neubert et al. 2016a
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Didymozoidae	*Allonematobothrium epinepheli* Yamaguti, 1965	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Didymozoidae	*Allonematobothrium epinepheli* Yamaguti, 1965	inner operculum	Palm & Rückert 2009
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Didymozoidae	*Allonematobothrium epinepheli* Yamaguti, 1965	inner operculum	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Didymozoidae	Didymozoidae indet. spp. (two species)	guts	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Didymozoidae	Didymozoidae indet. spp. (two species)	guts	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Didymozoidae	Didymozoidae indet. spp. (two species)	guts	Palm & Rückert 2009
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Didymozoidae	Didymozoidae indet. spp. (two species)	guts	Yuniar 2005
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Hemiuridae	*Lecithochirium magnaporum* Manter 1940	stomach	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Hemiuridae	*Lecithochirium* sp.[12]	stomach	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Opecoelidae	*Allopodocotyle epinepheli* (Yamaguti, 1942) Pritchard, 1966	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Opecoelidae	*Allopodocotyle epinepheli* (Yamaguti, 1942) Pritchard, 1966	intestine	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Opecoelidae	*Allopodocotyle* sp.	intestine	Bray et al. 2017
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Opecoelidae	*Cainocreadium epinepheli* (Yamaguti, 1934) Durio & Manter, 1968	intestine	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Opecoelidae	*Cainocreadium epinepheli* (Yamaguti, 1934) Durio & Manter, 1968	intestine	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Opecoelidae	*Podocotyloides stenometra* Pritchard, 1966	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Digenea	Sanguinicolidae	Sanguinicolidae indet. valid as: Aporocotylidae, see Apor.		
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Hirudinea	Piscicolidae	*Zeylanicobdella arugamensis* De Silva, 1963	surface	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Hirudinea	Piscicolidae	*Zeylanicobdella arugamensis* De Silva, 1963	surface	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Hirudinea	Piscicolidae	*Zeylanicobdella arugamensis* De Silva, 1963	surface	Palm & Rückert 2009
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Hirudinea	Piscicolidae	*Zeylanicobdella arugamensis* De Silva, 1963	surface	Yuniar 2005
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Microsporea	nr	Microsporea indet.	intestine	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Microsporea	nr	Microsporea indet.	intestine	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Microsporea	nr	Microsporea indet.	intestine	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Microsporea	nr	Microsporea indet.	intestine	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Ancyrocephalidae	*Haliotrema cromileptis* Young, 1968	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Ancyrocephalidae	*Haliotrema cromileptis* Young, 1968	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Capsalidae	*Benedenia epinepheli* (Yamaguti 1937)	surface	Rückert 2006

Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Capsalidae	*Benedenia epinepheli* (Yamaguti 1937)	surface	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Capsalidae	*Benedenia hoshinai* Ogawa, 1984	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Capsalidae	*Neobenedenia melleni* (MacCallum, 1927) Yamaguti, 1963	surface	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Capsalidae	*Neobenedenia melleni* (MacCallum, 1927) Yamaguti, 1963	surface	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Diplectanidae	*Pseudorhabdosynochus lantauensis* (Beverley-Burton & Suriano, 1981)	gills	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Diplectanidae	*Pseudorhabdosynochus lantauensis* (Beverley-Burton & Suriano, 1981)	gills	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Diplectanidae	*Pseudorhabdosynochus* spp.[27]	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Diplectanidae	*Pseudorhabdosynochus* spp.[27]	gills	Palm & Rückert 2009
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Diplectanidae	*Pseudorhabdosynochus* spp.[27]	gills	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Diplectanidae	*Pseudorhabdosynochus* spp.[27]	gills	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Diplectanidae	*Pseudorhabdosynochus* spp.[27]	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Monogenea	Diplectanidae	*Pseudorhabdosynochus* spp.[27]	gills	Yuniar 2005
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Myxozoa: Myxosporea	Ceratomyxidae	Myxozoa indet.[1]	gallbladder	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Acuariidae	*Paracuaria adunca* (Creplin, 1846)	intestine	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Capillariidae	*Capillaria* sp.	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Philometra epinepheli* Dewi & Palm, 2013	inner operculum	Dewi & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Philometra ocularis* Moravec et al. 2002	eye cavity	Dewi & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Philometra ocularis* Moravec et al. 2002	eye cavity	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Philometra ocularis* Moravec et al. 2002	eye cavity	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Philometra* spp. (two species)	operculum/mesenteries	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Philometra* spp. (two species)	operculum/mesenteries	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Philometra* spp. (two species)	operculum/mesenteries	Palm & Rückert 2009
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Philometra* spp. (two species)	operculum/mesenteries	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Philometra* spp. (two species)	operculum/mesenteries	Yuniar 2005
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Philometroides* sp.[40]	fins	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Philometroides* sp.[40]	fins	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Philometroides* sp.[40]	fins	Palm & Rückert 2009
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Philometroides* sp.[40]	fins	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Philometridae	*Spirophilometra endangae* Dewi & Palm, 2013	fins	Dewi & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Raphidascarididae	*Hysterothylacium* spp.[28] (two species)	nr	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Raphidascarididae	*Hysterothylacium* spp.[28] (two species)	intestine	Rückert 2006
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Raphidascarididae	*Hysterothylacium* spp.[28] (two species)	intestine	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	intestine	Kleinertz & Palm 2013
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	intestine	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	intestine	Rückert 2006

Perciformes	Serranidae	*Epinephelus coioides* (Hamilton, 1822)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	intestine	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus corallicola* (Valenciennes, 1828)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *acanthopagri* Lin, Ho & Chen, 1994	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus corallicola* (Valenciennes, 1828)	Crustacea: Copepoda	nr	Copepoda indet.	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus corallicola* (Valenciennes, 1828)	Crustacea: Copepoda	Pennellidae	Pennellidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus corallicola* (Valenciennes, 1828)	Crustacea: Isopoda	Corallanidae	*Argathona rhinoceros* (Bleeker, 1960)	gill cavity	Stolz 2017
Perciformes	Serranidae	*Epinephelus corallicola* (Valenciennes, 1828)	Crustacea: Isopoda	Corallanidae	Corrallanidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus corallicola* (Valenciennes, 1828)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus corallicola* (Valenciennes, 1828)	Digenea	Didymozoidae	*Allonematobothrium epinepheli* Yamaguti, 1965	operculum	Stolz 2017
Perciformes	**Serranidae**	***Epinephelus fasciatus* (Forsskål, 1775)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Epinephelus fasciatus* (Forsskål, 1775)**	**Digenea**	**Bivesiculidae**	***Bivesicula* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Epinephelus fasciatus* (Forsskål, 1775)**	**Digenea**	**Opecoelidae**	***Helicometra* cf. *fasciata* (Rudolphi, 1819) Odhner, 1902**	**intestine**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Epinephelus fasciatus* (Forsskål, 1775)**	**Nematoda**	**Camallanidae**	***Spirocamallanus* sp.**	**guts**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus fasciatus* (Forsskål, 1775)	Nematoda	Philometridae	*Philometra* sp.	mesenteries	Dewi & Palm 2017, workshop
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Cestoda	(Pseudophyllidea)	Pseudophyllidea indet. (larva)	intestine	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Cestoda	(Pseudophyllidea)	Pseudophyllidea indet. (larva)	intestine	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	stomach wall	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	stomach wall	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	stomach wall	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	stomach wall	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp.	gills	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* spp.	gills	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Crustacea: Copepoda	Lernanthropidae	*Sagum epinepheli* (Yamaguti & Yamasu, 1960)	gills	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Crustacea: Copepoda	Lernanthropidae	*Sagum epinepheli* (Yamaguti & Yamasu, 1960)	gills	Rückert et al. 2009a
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Crustacea: Copepoda	Pennellidae	Pennellidae indet.	gills	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Crustacea: Copepoda	Pennellidae	Pennellidae indet.	gills	Rückert et al. 2009a
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Rückert et al. 2009a
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Crustacea: Isopoda	Corallanidae	*Argathona rhinoceros* (Bleeker, 1960)	gill cavity	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Crustacea: Isopoda	Corallanidae	*Argathona rhinoceros* (Bleeker, 1960)	gill cavity	Rückert et al. 2009a
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Rückert et al. 2009a
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 1	intestine	Bray et al. 2018
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 1	intestine	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 1	intestine	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 1	intestine	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	intestine	Bray et al. 2018
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	intestine	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	intestine	Kleinertz 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	intestine	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Bucephalidae	*Prosorhynchus* sp. 2	intestine	Rückert et al. 2010

Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Didymozoidae	Didymozoidae indet. spp. (two species)	stomach/eye cavity	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Didymozoidae	Didymozoidae indet. spp. (two species)	stomach/eye cavity	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Hemiuridae	*Lecithochirium magnaporum* Manter 1940	stomach	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Hemiuridae	*Lecithochirium magnaporum* Manter 1940	stomach	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Opecoelidae	*Allopodocotyle epinepheli* (Yamaguti, 1942) Pritchard, 1966	intestine	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Digenea	Opecoelidae	*Allopodocotyle epinepheli* (Yamaguti, 1942) Pritchard, 1966	intestine	Rückert et al. 2010
Perciformes	**Serranidae**	***Epinephelus fuscoguttatus* (Forsskål, 1775)**	**Digenea**	**Opecoelidae**	***Pseudopecoelus* cf. *epinepheli* Wang, 1982**	**on swimbladder**	**Present study**
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Hirudinea	Piscicolidae	*Zeylanicobdella arugamensis* De Silva, 1963	surface	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Microsporea	nr	Microsporea indet.	mesenteries	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Microsporea	nr	Microsporea indet.	mesenteries	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Monogenea	Capsalidae	*Benedenia epinepheli* (Yamaguti 1937)	surface	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Monogenea	Capsalidae	*Benedenia epinepheli* (Yamaguti 1937)	surface	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Monogenea	Capsalidae	*Neobenedenia melleni* (MacCallum, 1927) Yamaguti, 1963	gills	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Monogenea	Capsalidae	*Neobenedenia melleni* (MacCallum, 1927) Yamaguti, 1963	gills	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Monogenea	Diplectanidae	*Pseudorhabdosynochus epinepheli* (Yamaguti, 1938) Kritsky & Beverley-Burton, 1986	gills	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Monogenea	Diplectanidae	*Pseudorhabdosynochus epinepheli* (Yamaguti, 1938) Kritsky & Beverley-Burton, 1986	gills	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Monogenea	Diplectanidae	*Pseudorhabdosynochus epinepheli* (Yamaguti, 1938) Kritsky & Beverley-Burton, 1986	gills	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Monogenea	Diplectanidae	*Pseudorhabdosynochus lantauensis* (Beverley-Burton & Suriano, 1981)	gills	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Monogenea	Diplectanidae	*Pseudorhabdosynochus lantauensis* (Beverley-Burton & Suriano, 1981)	gills	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Monogenea	Diplectanidae	*Pseudorhabdosynochus lantauensis* (Beverley-Burton & Suriano, 1981)	gills	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Myxozoa: Myxosporea	Ceratomyxidae	Myxozoa indet.[1]	gallbladder	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Myxozoa: Myxosporea	Ceratomyxidae	Myxozoa indet.[1]	gallbladder	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1983
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Anisakidae	*Terranova* sp.	mesenteries	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Anisakidae	*Terranova* sp.	mesenteries	Rückert et al. 2009a
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Camallanidae	*Camallanus carangis* Olsen, 1954	intestine	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Gnathostomatidae	*Echinocephalus* sp.	mesenteries	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Gnathostomatidae	*Echinocephalus* sp.	mesenteries	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Philometridae	cf. *Spirophilometra endangae* Dewi & Palm, 2013	fins	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Philometridae	cf. *Spirophilometra endangae* Dewi & Palm, 2013	fins	Rückert et al. 2009a
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Philometridae	cf. *Spirophilometra endangae* Dewi & Palm, 2013	fins	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Philometridae	cf. *Spirophilometra endangae* Dewi & Palm, 2013	fins	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Philometridae	*Philometra ocularis* Moravec et al. 2002	eye cavity	Dewi & Palm 2013
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Philometridae	*Philometra ocularis* Moravec et al. 2002	eye cavity	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Philometridae	*Philometra ocularis* Moravec et al. 2002	eye cavity	Rückert et al. 2009b
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Philometridae	*Philometra ocularis* Moravec et al. 2002	eye cavity	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Philometridae	*Philometra* sp.	operculum	Dewi & Palm 2013

Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Philometridae	*Philometra* sp.	operculum	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Philometridae	*Philometra* sp.	operculum	Rückert et al. 2009a
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Philometridae	*Philometroides* sp.[40]	fins	Dewi & Palm 2013
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	intestine	Rückert et al. 2010
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.[28]	intestine	Rückert 2006
Perciformes	Serranidae	*Epinephelus fuscoguttatus* (Forsskål, 1775)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	intestine	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus longispinis* (Kner, 1864)	Cestoda	Tentaculariidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	stomach wall	Palm 2004
Perciformes	Serranidae	*Epinephelus longispinis* (Kner, 1864)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017, workshop
Perciformes	Serranidae	*Epinephelus maculatus* (Bloch, 1790)	Nematoda	Anisakidae	Anisakidae indet.	nr	Burhanuddin & Djamali 1983
Perciformes	Serranidae	*Epinephelus maculatus* (Bloch, 1790)	Nematoda	Anisakidae	Anisakidae indet.	nr	Palm & Theisen et al. 2017
Perciformes	Serranidae	*Epinephelus maculatus* (Bloch, 1790)	Nematoda	Anisakidae	Anisakidae indet.	nr	Palm et al. 2008
Perciformes	**Serranidae**	***Epinephelus malabaricus* (Bloch & Schneider, 1801)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Epinephelus malabaricus* (Bloch & Schneider, 1801)**	**Monogenea**	**nr**	**Monogenea indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Serranidae**	***Epinephelus malabaricus* (Bloch & Schneider, 1801)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus merra* Bloch, 1793	Digenea	Opecoelidae	*Helicometra fasciata* (Rudolphi, 1819) Odhner, 1902	pyloric caeca	Yamaguti 1953b
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Cestoda	Tentaculariidae	*Nybelinia* sp.	pyloric caeca	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Crustacea: Copepoda	Caligidae	*Caligus* spp.[52]	gills	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Crustacea: Copepoda	Caligidae	*Caligus* spp.[52]	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Crustacea: Copepoda	Caligidae	*Lepeophtheirus epinepheli* Ho & Dojiri, 1977	gills	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Crustacea: Copepoda	Lernanthropidae	*Sagum epinepheli* (Yamaguti & Yamasu, 1960)	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Crustacea: Copepoda	Pennellidae	Pennellidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Crustacea: Isopoda	Corallanidae	Corrallanidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Digenea	Opecoelidae	*Macvicaria macassarensis* (Yamaguti, 1952) Bray & Cribb, 1989	pyloric caeca	Neubert et al. 2016a
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Monogenea	Capsalidae	*Benedenia hawaiiensis* Yamaguti, 1968	gills	Neubert et al. 2016a
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Monogenea	Diplectanidae	*Pseudorhabdosynochus quadratus* Schoelinck & Justine, 2011	gills	Neubert et al. 2016a
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Monogenea	Diplectanidae	*Pseudorhabdosynochus* sp.[27]	gills	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1983
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017, workshop
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Nematoda	Capillariidae	*Capillaria* sp.	stomach	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Nematoda	Philometridae	*Philometra* cf. *lateolabracis*[29] (Yamaguti, 1935) Yamaguti, 1961	gonads	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Nematoda	Philometridae	*Philometra epinepheli* Dewi & Palm, 2013	inner operculum	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Nematoda	Philometridae	*Philometra ocularis* Moravec et al. 2002	eye cavity	Neubert et al. 2016b
Perciformes	Serranidae	*Epinephelus ongus* (Bloch, 1790)	Nematoda	Raphidascarididae	*Hysterothylacium* sp. (nov.?)	intestine	Neubert et al. 2016b
Perciformes	**Serranidae**	***Epinephelus polyphekadion* (Bleeker, 1849)**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**intestine**	**Present study, workshop Bali**

Perciformes	**Serranidae**	***Epinephelus polyphekadion* (Bleeker, 1849)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	Serranidae	*Epinephelus quoyanus* (Valenciennes, 1830)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *acanthopagri* Lin, Ho & Chen, 1994	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus quoyanus* (Valenciennes, 1830)	Crustacea: Copepoda	Caligidae	*Caligus* spp.[52]	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus quoyanus* (Valenciennes, 1830)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus* sp. nov. 2	gill cavity	Stolz 2017
Perciformes	Serranidae	*Epinephelus quoyanus* (Valenciennes, 1830)	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus quoyanus* (Valenciennes, 1830)	Crustacea: Isopoda	Corallanidae	*Argathona rhinoceros* (Bleeker, 1960)	gill cavity	Nierstrasz 1931
Perciformes	Serranidae	*Epinephelus quoyanus* (Valenciennes, 1830)	Crustacea: Isopoda	Corallanidae	*Argathona rhinoceros* (Bleeker, 1960)	gill cavity	Stolz 2017
Perciformes	Serranidae	*Epinephelus quoyanus* (Valenciennes, 1830)	Crustacea: Isopoda	Corallanidae	Corrallanidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus quoyanus* (Valenciennes, 1830)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus quoyanus* (Valenciennes, 1830)	Digenea	Didymozoidae	*Didymodiclinus* cf. *epinepheli*[7] (Abdul-Salam et al., 1990) Pozdnyakov, 1994	gills	Stolz 2017
Perciformes	Serranidae	*Epinephelus quoyanus* (Valenciennes, 1830)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Burhanuddin & Djamali 1983
Perciformes	Serranidae	*Epinephelus quoyanus* (Valenciennes, 1830)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm & Theisen et al. 2017
Perciformes	Serranidae	*Epinephelus quoyanus* (Valenciennes, 1830)	Nematoda	Anisakidae	Anisakidae indet.	body cavity	Palm et al. 2008
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	mesenteries	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	mesenteries	Kayuzi 2014
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Catenulida	Stenostomidae	*Rhynchoscolex* sp.[59]	gills	Awik et al. 2009=Nurhayati et al. 2010
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	body cavity	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Cestoda	Tentaculariidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	stomach wall	Kayuzi 2014
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Ciliophora: Sessilida	Epistylididae	*Apiosoma* sp.[59]	gills	Awik et al. 2009=Nurhayati et al. 2010
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Ciliophora: Vestibuliferida	Balantidiidae	*Balantidium* sp.[59]	gills	Awik et al. 2009=Nurhayati et al. 2010
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Crustacea: Copepoda	Caligidae	*Caligus* sp.[52]	gills	Awik et al. 2009=Nurhayati et al. 2010
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Crustacea: Copepoda	Caligidae	*Lepeophtheirus* cf. *epinepheli* Ho & Dojiri, 1977	gills	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Crustacea: Copepoda	Chondracanthidae	*Chondracanthus nodosus* (Müller O.F., 1776)	gills	Awik et al. 2009=Nurhayati et al. 2010
Perciformes	**Serranidae**	***Epinephelus sexfasciatus* (Valenciennes, 1828)**	**Crustacea: Copepoda**	**Ergasilidae**	***Ergasilus* sp.**	**gills**	**Present study**
Perciformes	**Serranidae**	***Epinephelus sexfasciatus* (Valenciennes, 1828)**	**Crustacea: Copepoda**	**Lernaeopodidae**	**Lernaeopodidae indet.**	**gills**	**Present study**
Perciformes	**Serranidae**	***Epinephelus sexfasciatus* (Valenciennes, 1828)**	**Crustacea: Copepoda**	**Lernaeopodidae**	***Thysanote* cf. *lobiventris* (Heller, 1865)**	**mouth**	**Present study**
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Crustacea: Copepoda	Lernaeopodidae	*Thysanote fimbriata* (Heller, 1865)	mouth	Heller 1865
Perciformes	**Serranidae**	***Epinephelus sexfasciatus* (Valenciennes, 1828)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study**
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Digenea	Bucephalidae	*Prosorhynchus* cf. *luzonicus* Velasques, 1959	intestine	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Digenea	Bucephalidae	*Prosorhynchus* sp.[3]	intestine	Kayuzi 2014
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Digenea	Hemiuridae	Hemiuridae indet. (big, stout, "*Qadriana*-like")	stomach	Kayuzi 2014
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Digenea	Himasthlidae	cf. *Himasthla elongata* (Mehlis, 1831)	gills	Awik et al. 2009=Nurhayati et al. 2010
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Digenea	Opecoelidae	*Helicometra* sp.[19]	intestine	Kayuzi 2014
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Digenea	Transversotrematidae	*Transversotrema* sp.	fins	Awik et al. 2009=Nurhayati et al. 2010
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Monogenea	Ancyrocephalidae	*Haliotrema* sp.[24]	gills	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Monogenea	Diplectanidae	*Pseudorhabdosynochus* spp.[27]	gills	Awik et al. 2009=Nurhayati et al. 2010
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Arifudin & Abdulgani 2009
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Awik et al. 2009=Nurhayati et al. 2010
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Kayuzi 2014

Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	body cavity	Palm & Theisen et al. 2017, workshop
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Camallanidae	*Camallanus* sp.	stomach	Awik et al. 2009=Nurhayati et al. 2010
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Camallanidae	*Camallanus* sp.	stomach	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Camallanidae	*Camallanus* sp.	stomach	Kayuzi 2014
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Capillariidae	*Capillaria* sp.	stomach	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Capillariidae	*Capillaria* sp.	stomach	Kayuzi 2014
Perciformes	**Serranidae**	***Epinephelus sexfasciatus* (Valenciennes, 1828)**	**Nematoda**	**Philometridae**	***Philometra ocularis* Moravec et al. 2002**	**eye cavity**	**Present study**
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Philometridae	*Philometra* sp.	gonads	Hennersdorf et al. 2016
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Philometridae	*Philometra* sp.	gonads	Kayuzi 2014
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Philometridae	*Philometra* sp.	gonads	Palm et al. 2018
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Raphidascarididae	*Hysterothylacium* sp.[28]	guts	Kayuzi 2014
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Raphidascarididae	*Hysterothylacium* spp.[28] (two species)	guts	Hennersdorf et al. 2016
Perciformes	**Serranidae**	***Epinephelus sexfasciatus* (Valenciennes, 1828)**	**Nematoda**	**Raphidascarididae**	***Raphidascaris* sp.**	**stomach**	**Present study**
Perciformes	Serranidae	*Epinephelus sexfasciatus* (Valenciennes, 1828)	Nematoda	Rhadinorhynchidae	*Leptorhynchoides* sp.	gills	Awik et al. 2009=Nurhayati et al. 2010
Perciformes	Serranidae	*Epinephelus* spp.	Cestoda	nr	Cestoda indet.	nr	Hariyadi 2006
Perciformes	Serranidae	*Epinephelus* spp.	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Diani 1989
Perciformes	Serranidae	*Epinephelus* spp.	Ciliophora: Prorodontida	Holophryidae	*Cryptocaryon irritans* Brown, 1951	surface	Diani 1989
Perciformes	Serranidae	*Epinephelus* spp.	Crustacea: Iopoda	Cymothoidae	*Nerocila* sp.	surface	Diani 1989
Perciformes	Serranidae	*Epinephelus* spp.	Digenea	nr	Digenea indet.	nr	Hariyadi 2006
Perciformes	Serranidae	*Epinephelus* spp.	Nematoda	Anisakidae	*Anisakis* sp.[30]	body cavity	Detha et al. 2018
Perciformes	Serranidae	*Plectropomus leopardus* (Lacepède, 1802)	Crustacea: Copepoda	Chondracanthidae	*Acanthochondria cornuta* (Müller O.F., 1776)	gills	Sauyai et al. 2014
Perciformes	Serranidae	*Plectropomus leopardus* (Lacepède, 1802)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Sauyai et al. 2014
Perciformes	Serranidae	*Plectropomus leopardus* (Lacepède, 1802)	Digenea	Didymozoidae	*Unitubulotestis pelamydis* (Taschenburg, 1879)	gills	Sauyai et al. 2014
Perciformes	Serranidae	*Variola albimarginata* Baissac, 1953	Crustacea: Copepoda	Caligidae	*Caligus* spp.[52]	gills	Stolz 2017
Perciformes	Serranidae	*Variola albimarginata* Baissac, 1953	Crustacea: Copepoda	Hatschekiidae	*Hatschekia* cf. *cadenati* Nuñes-Ruivo, 1954	gills	Stolz 2017
Perciformes	Serranidae	*Variola albimarginata* Baissac, 1953	Crustacea: Copepoda	Hatschekiidae	*Hatschekia* cf. *louti* Lee, S., Lee, W. & Boxshall, 2013	gills	Stolz 2017
Perciformes	Serranidae	*Variola albimarginata* Baissac, 1953	Crustacea: Copepoda	nr	Copepoda indet.	gills	Stolz 2017
Perciformes	Serranidae	*Variola albimarginata* Baissac, 1953	Crustacea: Copepoda	Pennellidae	Pennellidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Variola albimarginata* Baissac, 1953	Crustacea: Isopoda	Corallanidae	*Alcirona* sp.	gills	Stolz 2017
Perciformes	Serranidae	*Variola albimarginata* Baissac, 1953	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Stolz 2017
Perciformes	Serranidae	*Variola albimarginata* Baissac, 1953	Digenea	Didymozoidae	*Allonematobothrium epinepheli* Yamaguti, 1965	operculum	Stolz 2017
Perciformes	**Serranidae**	***Variola albimarginata* Baissac, 1953**	**Nematoda**	**Anisakidae**	***Anisakis* sp.[30]**	**mesenteries**	**Present study**
Perciformes	**Serranidae**	***Variola louti* (Forsskål, 1775)**	**Nematoda**	**Anisakidae**	***Anisakis* sp.[30]**	**mesenteries**	**Present study**
Perciformes	Serranidae	*Variola louti* (Forsskål, 1775)	Nematoda	Philometridae	*Philometra ocularis* Moravec et al. 2002	eye cavity	Dewi & Palm 2017
Perciformes	Serranidae	*Variola louti* (Forsskål, 1775)	Nematoda	Philometridae	*Philometra* sp.	gonads	Dewi & Palm 2017
Perciformes	**Siganidae**	***Siganus canaliculatus* (Park, 1797)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**gills**	**Present study, workshop Bali**
Perciformes	Siganidae	*Siganus canaliculatus* (Park, 1797)	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Monod & Serène 1976
Perciformes	Siganidae	*Siganus canaliculatus* (Park, 1797)	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Monod 1976
Perciformes	**Siganidae**	***Siganus canaliculatus* (Park, 1797)**	**Digenea**	**Apocreadiidae**	***Plesioschistorchis sigani* (Yamaguti, 1942) Blend, Karar & Dronen, 2017**	**guts**	**Present study, workshop Bali**

Perciformes	**Siganidae**	***Siganus canaliculatus* (Park, 1797)**	**Digenea**	**Atractotrematidae**	***Atractotrema sigani* Durio & Manter, 1969**	**guts**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus canaliculatus* (Park, 1797)**	**Monogenea**	**Dactylogyridae**	**Dactylogyridae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus doliatus* Guérin-Méneville, 1829-38**	**Digenea**	**Aporocotylidae**	***Phthinomita* sp. (nov.!?)**	**heart**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus guttatus* (Bloch, 1787)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**intestine**	**Present study, workshop Bali**
Perciformes	Siganidae	*Siganus guttatus* (Bloch, 1787)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Muthmainnah 2004
Perciformes	Siganidae	*Siganus guttatus* (Bloch, 1787)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Slade 2001
Perciformes	**Siganidae**	***Siganus guttatus* (Bloch, 1787)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus uniartus* (Ho, Kim, Cruz & Nagasawa, 2004)**	**fins**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus guttatus* (Bloch, 1787)**	**Crustacea: Copepoda**	**Caligidae**	***Lepeophtheirus atypicus* Lin, Ho & Chen, 1996**	**surface**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus guttatus* (Bloch, 1787)**	**Crustacea: Copepoda**	**Hatschekiidae**	***Hatschekia* cf. *sigani* v. *siganicola***	**gills**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus guttatus* (Bloch, 1787)**	**Digenea**	**Aporocotylidae**	***Phthinomita* sp. (nov.!?)**	**heart**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus guttatus* (Bloch, 1787)**	**Digenea**	**nr**	**Digenea indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus guttatus* (Bloch, 1787)**	**Monogenea**	**Capsalidae**	**Capsalidae indet.**	**gills**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus guttatus* (Bloch, 1787)**	**Monogenea**	**Gyrodactylidae**	***Acanthoplacatus* cf. *sigani* Ernst, Jones & Whittington, 2001**	**fins**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus guttatus* (Bloch, 1787)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus guttatus* (Bloch, 1787)**	**Myxozoa: Myxosporea**	**Myxidiidae**	***Myxidium* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	Siganidae	*Siganus guttatus* (Bloch, 1787)	Nematoda	Anisakidae	Anisakidae indet.	nr	Burhanuddin & Djamali 1983
Perciformes	Siganidae	*Siganus guttatus* (Bloch, 1787)	Nematoda	Anisakidae	Anisakidae indet.	nr	Palm & Theisen et al. 2017
Perciformes	Siganidae	*Siganus guttatus* (Bloch, 1787)	Nematoda	Anisakidae	Anisakidae indet.	nr	Palm et al. 2008
Perciformes	**Siganidae**	***Siganus guttatus* (Bloch, 1787)**	**Nematoda**	**Camallanidae**	***Spirocamallanus* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	Siganidae	*Siganus javus* (Linnaeus, 1766)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Muthmainnah 2004
Perciformes	Siganidae	*Siganus javus* (Linnaeus, 1766)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Slade 2001
Perciformes	Siganidae	*Siganus javus* (Linnaeus, 1766)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *quadratus* Shiino, 1954	surface	Yuniar 2005
Perciformes	Siganidae	*Siganus javus* (Linnaeus, 1766)	Crustacea: Copepoda	Caligidae	*Caligus* cf. *quadratus* Shiino, 1954	surface	Yuniar et al. 2007
Perciformes	Siganidae	*Siganus javus* (Linnaeus, 1766)	Crustacea: Copepoda	Caligidae	*Caligus epidemicus* Hewitt, 1971	surface	Yuniar 2005
Perciformes	Siganidae	*Siganus javus* (Linnaeus, 1766)	Crustacea: Copepoda	Caligidae	*Caligus epidemicus* Hewitt, 1971	surface	Yuniar et al. 2007
Perciformes	**Siganidae**	***Siganus javus* (Linnaeus, 1766)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus uniartus* (Ho, Kim, Cruz & Nagasawa, 2004)**	**fins**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus javus* (Linnaeus, 1766)**	**Crustacea: Copepoda**	**Caligidae**	***Lepeophtheirus atypicus* Lin, Ho & Chen, 1996**	**surface**	**Present study, workshop Bali**
Perciformes	Siganidae	*Siganus javus* (Linnaeus, 1766)	Crustacea: Copepoda	Ergasilidae	*Ergasilus* sp.	gills	Yuniar 2005
Perciformes	Siganidae	*Siganus javus* (Linnaeus, 1766)	Crustacea: Copepoda	Ergasilidae	*Ergasilus* sp.	gills	Yuniar et al. 2007
Perciformes	Siganidae	*Siganus javus* (Linnaeus, 1766)	Hirudinea	Piscicolidae	*Zeylanicobdella arugamensis* De Silva, 1963	surface	Rückert et al. 2009a
Perciformes	Siganidae	*Siganus javus* (Linnaeus, 1766)	Hirudinea	Piscicolidae	*Zeylanicobdella arugamensis* De Silva, 1963	surface	Yuniar 2005
Perciformes	**Siganidae**	***Siganus javus* (Linnaeus, 1766)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus punctatus* (Schneider & Forster, 1801)**	**Digenea**	**Apocreadiidae**	***Plesioschistorchis* cf. *sigani* (Yamaguti, 1942) Blend et al., 2017**	**guts**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus punctatus* (Schneider & Forster, 1801)**	**Digenea**	**Aporocotylidae**	***Phthinomita* sp. (nov.!?)**	**heart**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus punctatus* (Schneider & Forster, 1801)**	**Digenea**	**Microscaphidiidae**	***Hexangium* cf. *sigani* Goto & Ozaki, 1929**	**intestine**	**Present study, workshop Bali**
Perciformes	Siganidae	*Siganus* sp.	Crustacea: Copepoda	Hatschekiidae	*Hatschekia teuthidis* Yamaguti, 1954	gills	Yamaguti 1954c
Perciformes	Siganidae	*Siganus* sp.	Crustacea: Isopoda	Gnathiidae	*Gnathia maxillaris* (Montagu, 1804)[57]	gills	Sidabalok 2013
Perciformes	Siganidae	*Siganus* sp.	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Sirikan 1981
Perciformes	Siganidae	*Siganus* sp.	Digenea	Apocreadiidae	*Plesioschistorchis* cf. *sigani* (Yamaguti, 1942) Blendet al., 2017	intestine	Yamaguti 1953b
Perciformes	Siganidae	*Siganus* sp.	Digenea	Gyliauchenidae	*Gyliauchen nahaensis* Ozaki, 1937	pyloric caeca	Yamaguti 1953b

Perciformes	Siganidae	*Siganus* sp.	Digenea	Gyliauchenidae	*Gyliauchen papillatus* (Goto & Matsudaira, 1918)	intestine	Yamaguti 1953b
Perciformes	Siganidae	*Siganus* sp.	Digenea	Lecithasteridae	*Hysterolecithoides epinepheli* Yamaguti, 1934	stomach	Yamaguti 1953b
Perciformes	Siganidae	*Siganus* sp.	Digenea	Microscaphidiidae	*Hexangium sigani* Goto & Ozaki, 1929	intestine	Yamaguti 1953b
Perciformes	Siganidae	*Siganus* sp.	Monogenea	Ancyrocephalidae	*Pseudohaliotrema sphincteroporus* Yamaguti, 1953	gills	Yamaguti 1953a
Perciformes	Siganidae	*Siganus* sp.	Monogenea	Ancyrocephalidae	*Tetrancistrum fusiforme* (Yamaguti, 1953)	gills	Yamaguti 1953a
Perciformes	Siganidae	*Siganus* sp.	Nematoda	Camallanidae	*Procamallanus annulatus* Yamaguti, 1954	pyloric caeca	Yamaguti 1954c
Perciformes	Siganidae	*Siganus* sp.	Nematoda	Cucullanidae	*Cucullanus sigani* Yamaguti, 1954	pyloric caeca	Yamaguti 1954c
Perciformes	**Siganidae**	***Siganus spinus* (L.)**	**Digenea**	**Aporocotylidae**	***Phthinomita* sp. (nov.!?)**	**heart**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus spinus* (L.)**	**Digenea**	**Microscaphidiidae**	***Hexangium* cf. *sigani* Goto & Ozaki, 1929**	**intestine**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus spinus* (L.)**	**Nematoda**	**Camallanidae**	***Spirocamallanus* sp.**	**intestine**	**Present study, workshop Bali**
Perciformes	Siganidae	*Siganus vermiculatus* (Valenciennes, 1835)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Muthmainnah 2004
Perciformes	Siganidae	*Siganus vermiculatus* (Valenciennes, 1835)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Slade 2001
Perciformes	**Siganidae**	***Siganus vermiculatus* (Valenciennes, 1835)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus uniartus* (Ho, Kim, Cruz & Nagasawa, 2004)**	**fins**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus vermiculatus* (Valenciennes, 1835)**	**Crustacea: Copepoda**	**Caligidae**	***Lepeophtheirus atypicus* Lin, Ho & Chen, 1996**	**surface**	**Present study, workshop Bali**
Perciformes	**Siganidae**	***Siganus vermiculatus* (Valenciennes, 1835)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Perciformes	Sillaginidae	*Sillago aeolus* Jordan & Evermann, 1902	Crustacea: Copepoda	Philichthyidae	*Colobomatus sillaginis* West, 1983	lateral line canal	Hayward 1996b
Perciformes	Sillaginidae	*Sillago aeolus* Jordan & Evermann, 1902	Monogenea	Microcotylidae	*Polylabris silliaginae* (Woolcock, 1936)	gills	Hayward 1996d
Perciformes	Sillaginidae	*Sillago sihama* (Forsskål, 1775)	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus* sp.	gills	Hayward 1996a
Perciformes	Sillaginidae	*Sillago sihama* (Forsskål, 1775)	Crustacea: Copepoda	Lernanthropidae	*Lernanthropus sillaginis* Pillai, 1963	gills	Hayward 1996a
Perciformes	**Sillaginidae**	***Sillago sihama* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	Sillaginidae	*Sillago sihama* (Forsskål, 1775)	Crustacea: Copepoda	Philichthyidae	*Colobomatus sillaginis* West, 1983	nr	West 1992
Perciformes	Sillaginidae	*Sillago sihama* (Forsskål, 1775)	Monogenea	Diplectanidae	*Paradiplectanum blairense* (Gupta & Khanna, 1974) Domingues & Boeger, 2008	gills	Hayward 1996c
Perciformes	Sillaginidae	*Sillago sihama* (Forsskål, 1775)	Monogenea	Diplectanidae	*Paradiplectanum sillagonum* (Tripathi, 1959) Domingues & Boeger, 2008	gills	Hayward 1996c
Perciformes	Sillaginidae	*Sillago sihama* (Forsskål, 1775)	Monogenea	Microcotylidae	*Polynemicola* sp.	gills	Hayward 1997
Perciformes	**Sparidae**	***Acanthopagrus berda* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus epinepheli* Yamaguti, 1936**	**gills**	**Present study**
Perciformes	**Sparidae**	***Acanthopagrus berda* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**gills**	**Present study**
Perciformes	**Sparidae**	***Acanthopagrus berda* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Caligidae**	***Lepeophtheirus* sp.**	**gills**	**Present study**
Perciformes	**Sparidae**	***Acanthopagrus berda* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Ergasilidae**	***Ergasilus* sp.**	**gills**	**Present study**
Perciformes	**Sparidae**	***Acanthopagrus berda* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropus* sp.**	**gills**	**Present study**
Perciformes	**Sparidae**	***Acanthopagrus berda* (Forsskål, 1775)**	**Digenea**	**Bucephalidae**	***Prosorhynchus* sp. 2**	**guts**	**Present study**
Perciformes	**Sparidae**	***Acanthopagrus berda* (Forsskål, 1775)**	**Digenea**	**Hemiuridae**	***Qadriana fusiformis* Bilqees, 1971**	**stomach**	**Present study**
Perciformes	**Sparidae**	***Acanthopagrus berda* (Forsskål, 1775)**	**Digenea**	**nr**	**Digenea indet. spp. (two species/morphotypes)**	**guts**	**Present study**
Perciformes	**Sparidae**	***Acanthopagrus berda* (Forsskål, 1775)**	**Hirudinea**	**Piscicolidae**	**Piscicolidae indet.**	**gills**	**Present study**
Perciformes	**Sparidae**	***Acanthopagrus berda* (Forsskål, 1775)**	**Monogenea**	**(Polyopisthocotylea)**	**Polyopisthocotylea indet.**	**gills**	**Present study**
Perciformes	**Sparidae**	***Acanthopagrus berda* (Forsskål, 1775)**	**Nematoda**	**Camallanidae**	***Procamallanus (Spirocamallanus) spiralis* Baylis, 1922 v. *berdii* (Khan & Yaseen, 1969)**	**intestine**	**Present study**
Perciformes	**Sparidae**	***Acanthopagrus berda* (Forsskål, 1775)**	**Nematoda**	**Philometridae**	***Philometra* sp.**	**body cavity**	**Present study**
Perciformes	Sphyraenidae	*Sphyraena barracuda* (Edwards, 1771)	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	stomach wall	Palm 2004
Perciformes	Sphyraenidae	*Sphyraena* sp.	Digenea	Bucephalidae	*Bucephalus sphyraenae* Yamaguti, 1952	pyloric caeca	Bray et al. 2018
Perciformes	Sphyraenidae	*Sphyraena* sp.	Digenea	Bucephalidae	*Bucephalus sphyraenae* Yamaguti, 1952	pyloric caeca	Yamaguti 1952

Perciformes	Sphyraenidae	*Sphyraena* sp.	Digenea	Bucephalidae	*Prosorhynchus longicollis* Yamaguti, 1953	pyloric caeca	Bray et al. 2018
Perciformes	Sphyraenidae	*Sphyraena* sp.	Digenea	Bucephalidae	*Prosorhynchus longicollis* Yamaguti, 1953	pyloric caeca	Yamaguti 1953b
Perciformes	Sphyraenidae	*Sphyraena* sp.	Digenea	Bucephalidae	*Rhipidocotyle khalili* Nagaty, 1937	pyloric caeca	Bray et al. 2018
Perciformes	Sphyraenidae	*Sphyraena* sp.	Digenea	Bucephalidae	*Rhipidocotyle khalili* Nagaty, 1937	pyloric caeca	Yamaguti 1953b
Perciformes	Sphyraenidae	*Sphyraena* sp.	Digenea	Hemiuridae	*Plerurus digitatus* (Looss, 1899) Looss, 1907	stomach	Yamaguti 1952
Perciformes	Sphyraenidae	*Sphyraena* sp.	Monogenea	Diplectanidae	*Pseudolamellodiscus sphyraenae* Yamaguti 1953	gills	Yamaguti 1953a
Perciformes	Stromateidae	*Pampus argenteus* (Euphrasen, 1788)	Crustacea: Copepoda	Bomolochidae	*(Notho-?)Bomolochus* sp.	gills	Iman 2012
Perciformes	**Stromateidae**	***Pampus argenteus* (Euphrasen, 1788)**	**Crustacea: Copepoda**	**Bomolochidae**	***(Notho-?)Bomolochus* sp.**	**gills**	**Present study**
Perciformes	Stromateidae	*Pampus argenteus* (Euphrasen, 1788)	Crustacea: Copepoda	Caligidae	*Synestius caliginus* Steenstrup & Lütken, 1861	gills	Heller 1865
Perciformes	Stromateidae	*Pampus argenteus* (Euphrasen, 1788)	Digenea	Lepocreadiidae	*Lepidapedoides* sp.	intestine	Iman 2012
Perciformes	**Stromateidae**	***Pampus argenteus* (Euphrasen, 1788)**	**Digenea**	**Lepocreadiidae**	***Lepidapedoides* sp.**	**intestine**	**Present study**
Perciformes	Stromateidae	*Pampus argenteus* (Euphrasen, 1788)	Digenea	Opecoelidae	Opecoelidae indet.	intestine	Iman 2012
Perciformes	**Stromateidae**	***Pampus argenteus* (Euphrasen, 1788)**	**Digenea**	**Opecoelidae**	**Opecoelidae indet.**	**intestine**	**Present study**
Perciformes	**Stromateidae**	***Pampus argenteus* (Euphrasen, 1788)**	**Digenea**	**Sclerodistomidae**	***Prosorchis pampi* Ho & Kim, 1992**	**intestine**	**Present study**
Perciformes	Stromateidae	*Pampus argenteus* (Euphrasen, 1788)	Digenea	Sclerodistomidae	*Prosorchis* sp.[22]	intestine	Iman 2012
Perciformes	Stromateidae	*Pampus argenteus* (Euphrasen, 1788)	Monogenea	(Polyopisthocotylea)	Polyopisthocotylea indet.	gills	Iman 2012
Perciformes	**Stromateidae**	***Pampus argenteus* (Euphrasen, 1788)**	**Monogenea**	**(Polyopisthocotylea)**	**Polyopisthocotylea indet.**	**gills**	**Present study**
Perciformes	Stromateidae	*Pampus argenteus* (Euphrasen, 1788)	Nematoda	Philometridae	*Philometra* sp.	gonads	Iman 2012
Perciformes	**Stromateidae**	***Pampus argenteus* (Euphrasen, 1788)**	**Nematoda**	**Philometridae**	***Philometra* sp.**	**gonads**	**Present study**
Perciformes	Stromateidae	*Stromateus* sp.	Crustacea: Copepoda	Caligidae	*Caligus constrictus* Heller, 1865	gills	Heller 1865
Perciformes	Stromateidae	*Stromateus* sp.	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	nr	Nierstrasz 1915
Perciformes	Stromateidae	*Stromateus* sp.	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Sachlan 1955
Perciformes	**Terapontidae**	***Terapon jarbua* (Forsskål, 1775)**	**Acanthocephala**	**nr**	**Acanthocephala indet.**	**mesenteries**	**Present study**
Perciformes	Terapontidae	*Terapon jarbua* (Forsskål, 1775)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Muthmainnah 2004
Perciformes	Terapontidae	*Terapon jarbua* (Forsskål, 1775)	Ciliophora: Mobilida	Trichodinidae	*Trichodina* sp.	surface	Slade 2001
Perciformes	Terapontidae	*Terapon jarbua* (Forsskål, 1775)	Crustacea: Copepoda	Bomolochidae	Bomolochidae indet.	mouth cavity	Hartono 2012
Perciformes	**Terapontidae**	***Terapon jarbua* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Bomolochidae**	**Bomolochidae indet.**	**mouth cavity**	**Present study**
Perciformes	Terapontidae	*Terapon jarbua* (Forsskål, 1775)	Crustacea: Copepoda	Caligidae	*Caligus* sp.	gills	Hartono 2012
Perciformes	**Terapontidae**	***Terapon jarbua* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Caligidae**	***Caligus* sp.**	**gills**	**Present study**
Perciformes	Terapontidae	*Terapon jarbua* (Forsskål, 1775)	Crustacea: Copepoda	Ergasilidae	*Ergasilus* sp.	operculum	Hartono 2012
Perciformes	**Terapontidae**	***Terapon jarbua* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Ergasilidae**	***Ergasilus* sp.**	**operculum**	**Present study**
Perciformes	Terapontidae	*Terapon jarbua* (Forsskål, 1775)	Crustacea: Copepoda	Lernaeopodidae	*Naobranchia* sp.	gills	Hartono 2012
Perciformes	**Terapontidae**	***Terapon jarbua* (Forsskål, 1775)**	**Crustacea: Copepoda**	**Lernaeopodidae**	***Naobranchia* sp.**	**gills**	**Present study**
Perciformes	**Terapontidae**	***Terapon jarbua* (Forsskål, 1775)**	**Digenea**	**Bucephalidae**	***Prosorhynchus* sp.**	**stomach**	**Present study**
Perciformes	**Terapontidae**	***Terapon jarbua* (Forsskål, 1775)**	**Digenea**	**Hemiuridae**	***Lecithocladium* sp.**	**stomach**	**Present study**
Perciformes	**Terapontidae**	***Terapon jarbua* (Forsskål, 1775)**	**Microsporea**	**nr**	**Microsporea indet.**	**stomach wall**	**Present study**
Perciformes	Terapontidae	*Terapon jarbua* (Forsskål, 1775)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	mesenteries	Palm & Theisen et al. 2017
Perciformes	Terapontidae	*Terapon jarbua* (Forsskål, 1775)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	mesenteries	Setyobudi et al. 2011
Perciformes	**Terapontidae**	***Terapon jarbua* (Forsskål, 1775)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**mesenteries**	**Present study**
Perciformes	**Terapontidae**	***Terapon puta* Cuvier, 1829**	**Digenea**	**Heterophyidae**	**Heterophyidae indet.**	**heart (!)**	**Present study, workshop Bali**

Perciformes	**Terapontidae**	***Terapon theraps* Cuvier, 1829**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**intestine**	**Present study, workshop Bali**
Perciformes	**Terapontidae**	***Terapon theraps* Cuvier, 1829**	**Ciliophora: Mobilida**	**Trichodinidae**	***Trichodina* sp.**	**gills**	**Present study, workshop Bali**
Perciformes	**Terapontidae**	***Terapon theraps* Cuvier, 1829**	**Digenea**	**Heterophyidae**	**Heterophyidae indet.**	**heart (!)**	**Present study, workshop Bali**
Perciformes	Tetraodontidae	*Tylerius spinosissimus* (Regan, 1908)	Digenea	Aporocotylidae	*Psettarium pulchellum* Yong et al., 2016	heart	Yong et al. 2016, workshop Bali
Perciformes	Trichiuridae	*Lepturacanthus savala* (Cuvier, 1829)	Acanthocephala	Polymorphidae	*Bolbosoma vasculosum* (Rudolphi, 1819)	nr	Verweyen et al. 2011
Perciformes	Trichiuridae	*Lepturacanthus savala* (Cuvier, 1829)	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	nr	Palm 2004
Perciformes	Trichiuridae	*Lepturacanthus savala* (Cuvier, 1829)	Nematoda	Anisakidae	*Anisakis simplex*[31] (Rudolphi, 1809)	guts	Rahmawati 2014
Perciformes	Trichiuridae	*Lepturacanthus savala* (Cuvier, 1829)	Nematoda	Anisakidae	*Anisakis* sp. "HC-2005"	nr	Kuhn et al. 2013
Perciformes	Trichiuridae	*Lepturacanthus savala* (Cuvier, 1829)	Nematoda	Anisakidae	*Anisakis* sp. "HC-2005"	nr	Kuhn et al. 2011
Perciformes	Trichiuridae	*Lepturacanthus savala* (Cuvier, 1829)	Nematoda	Anisakidae	*Anisakis* sp. "HC-2005"	nr	Palm & Theisen et al. 2017
Perciformes	Trichiuridae	*Lepturacanthus savala* (Cuvier, 1829)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	nr	Kuhn et al. 2013
Perciformes	Trichiuridae	*Lepturacanthus savala* (Cuvier, 1829)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	nr	Kuhn et al. 2011
Perciformes	Trichiuridae	*Lepturacanthus savala* (Cuvier, 1829)	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	nr	Palm & Theisen et al. 2017
Perciformes	Trichiuridae	*Lepturacanthus savala* (Cuvier, 1829)	Nematoda	Camallanidae	*Camallanus spinosus*[32] *nomen dubium*	guts	Rahmawati 2014
Perciformes	Trichiuridae	*Lepturacanthus savala* (Cuvier, 1829)	Nematoda	Philometridae	*Philometroides trichiuri* Moravec, Walter & Yuniar, 2012	fins	Moravec et al. 2012
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Acanthocephala	Neoechinorhynchidae	*Neoechinorhynchus* sp.	intestine wall	Theisen 2009
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Acanthocephala	Rhadinorhynchidae	*Gorgorhynchus* cf. *robertdollfusi* Golvan, 1956	body cavity	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Acanthocephala	Rhadinorhynchidae	*Gorgorhynchus* cf. *robertdollfusi* Golvan, 1956	body cavity	Jakob 2005
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Acanthocephala	Rhadinorhynchidae	*Gorgorhynchus* sp.	pyloric caeca	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Acanthocephala	Rhadinorhynchidae	*Gorgorhynchus* sp.	pyloric caeca	Jakob 2005
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Acanthocephala	Rhadinorhynchidae	*Rhadinorhynchus* sp.	nr	Theisen 2009
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	intestine	Jakob 2005
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Cestoda**	**(Tetraphyllidea)**	**Tetraphyllidea indet.**	**intestine**	**Present study**
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Bothriocephalidae	*Bothriocephalus* sp.	guts	Theisen 2009
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Eutetrarhynchidae	*Oncomegas javensis* Palm, 2004	stomach wall	Palm 2004
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Lacistorhynchidae	*Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931	mesenteries	Palm 2004
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Lacistorhynchidae	*Callitetrarhynchus speciosus* (Linton, 1897) Carvajal & Rego, 1985	musculature	Palm 2004
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Lacistorhynchidae	*Grillotia (Christianella) yuniariae* Palm, 2004	stomach wall	Palm 2004
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Lacistorhynchidae	*Pseudogrillotia multiminacantha* Palm, 2004	body cavity	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Lacistorhynchidae	*Pseudogrillotia multiminacantha* Palm, 2004	body cavity	Jakob 2005
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Lacistorhynchidae	*Pseudogrillotia multiminacantha* Palm, 2004	musculature	Palm 2004
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Tentaculariidae	*Mixonybelinia lepturi* Palm, 2004	nr	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Tentaculariidae	*Mixonybelinia lepturi* Palm, 2004	nr	Jakob 2005
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Tentaculariidae	*Mixonybelinia lepturi* Palm, 2004		Palm 2004
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Tentaculariidae	*Mixonybelinia southwelli* (Palm & Walter, 1999) Palm, 1999	stomach wall	Palm 2004
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Tentaculariidae	*Nybelinia africana* Dollfus, 1960	stomach wall	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Tentaculariidae	*Nybelinia africana* Dollfus, 1960	stomach wall	Jakob 2005
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Tentaculariidae	*Nybelinia africana* Dollfus, 1960	body cavity	Palm 2004
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	stomach wall	Palm 2004

Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	stomach wall	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	stomach wall	Jakob 2005
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Tentaculariidae	Tentaculariidae indet.	stomach wall	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Cestoda	Tentaculariidae	Tentaculariidae indet.	stomach wall	Jakob 2005
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus* sp.[54]	gills	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Copepoda	Bomolochidae	*Nothobomolochus* sp.[54]	gills	Jakob 2005
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Crustacea: Copepoda**	**Caligidae**	***Caligus longipedis* Bassett-Smith, 1898**	**gills**	**Present study**
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Copepoda	Caligidae	*Metacaligus trichiuri* (Krøyer, 1863)	mouth cavity	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Copepoda	Caligidae	*Metacaligus trichiuri* (Krøyer, 1863)	mouth cavity	Jakob 2005
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Copepoda	Caligidae	*Metacaligus trichiuri* (Krøyer, 1863)	mouth cavity	Theisen 2009
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Crustacea: Copepoda**	**Caligidae**	***Metacaligus trichiuri* (Krøyer, 1863)**	**mouth cavity**	**Present study**
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Copepoda	Lernaeopodidae	*Brachiella trichiuri* (*sensu lato*) Gnanamuthu, 1951	mouth cavity	Theisen 2009
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Crustacea: Copepoda**	**Lernaeopodidae**	***Brachiella trichiuri* (*sensu lato*) Gnanamuthu, 1951**	**mouth cavity**	**Present study**
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Copepoda	Lernanthropidae	*Lernanthropinus forficatus* (Redkar, Rangnekar & Murti, 1949)	gills	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Copepoda	Lernanthropidae	*Lernanthropinus forficatus* (Redkar, Rangnekar & Murti, 1949)	gills	Jakob 2005
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Copepoda	Lernanthropidae	*Lernanthropinus forficatus* (Redkar, Rangnekar & Murti, 1949)	gills	Theisen 2009
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Crustacea: Copepoda**	**Lernanthropidae**	***Lernanthropinus forficatus* (Redkar, Rangnekar & Murti, 1949)**	**gills**	**Present study**
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Crustacea: Copepoda**	**Pennellidae**	**(Pennellidae indet.) parasitic on 763**	**mouth cavity**	**Present study**
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Crustacea: Copepoda**	**Pennellidae**	***Propeniculus trichiuri* (Gnanamuthu, 1951)**	**surface**	**Present study**
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Crustacea: Iopoda**	**(Cymothooidea)**	**Cymothooidea indet.**	**gills**	**Present study**
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Isopoda	Cymothoidae	*Lobothorax typus* Bleeker, 1857	nr	Bleeker 1857
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Isopoda	Cymothoidae	*Lobothorax typus* Bleeker, 1857	nr	Nierstrasz 1931
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Isopoda	Cymothoidae	*Lobothorax typus* Bleeker, 1857	nr	Sidabalok 2013
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Isopoda	Cymothoidae	*Lobothorax typus* Bleeker, 1857	mouth cavity	Theisen 2009
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Crustacea: Isopoda	Cymothoidae	*Lobothorax typus* Bleeker, 1857	nr	Schiødte & Meinert 1879-1884
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Crustacea: Isopoda**	**Cymothoidae**	***Lobothorax typus* Bleeker, 1857**	**mouth cavity**	**Present study**
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Digenea	Acanthocolpidae	*Stephanostomum* sp.	intestine	Theisen 2009
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Digenea**	**Bucephalidae**	**Bucephalidae indet.**	**intestine**	**Present study**
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Digenea**	**Bucephalidae**	***Rhipidocotyle* sp.**	**stomach**	**Present study**
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Digenea**	**Hemiuridae**	***Lecithochirium* sp.**	**stomach**	**Present study**
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Digenea	Hemiuridae	*Lecithochirium* sp.[16]	stomach	Theisen 2009
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Digenea	Hemiuridae	*Lecithochirium trichiuri* Gu & Shen, 1981	stomach	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Digenea	Hemiuridae	*Lecithochirium trichiuri* Gu & Shen, 1981	stomach	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Digenea	Hemiuridae	*Lecithochirium trichiuri* Gu & Shen, 1981	stomach	Jakob 2005
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Digenea	Hemiuridae	*Lecithochirium trichiuri* Gu & Shen, 1981	stomach	Jakob 2005
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Digenea**	**Hemiuridae**	***Lecithochirium trichiuri* Gu & Shen, 1981**	**stomach**	**Present study**
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Digenea**	**Hemiuridae**	***Lecithocladium* sp.**	**stomach**	**Present study**
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Monogenea**	**(Monopisthocotylea)**	**Monopisthocotylea indet.**	**gills**	**Present study**
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Monogenea**	**Plectanocotylidae**	**cf. *Octoplectanocotyla trichiuri* Yamaguti, 1937**	**gills**	**Present study**
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis* sp.[30]	guts	Jakob & Palm 2006

Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis* sp.[30]	guts	Palm et al. 2008
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis* sp.[30]	guts	Setyobudi et al. 2007
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis* sp.[30]	guts	Setyobudi et al. 2011
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis* sp.[30]	guts	Theisen 2009
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis* spp.[30]	guts	Semarariana et al. 2012
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	intestine	Kuhn et al. 2013
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	intestine	Kuhn et al. 2011
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis typica* (*sensu stricto*) (Diesing, 1860) Baylis, 1920	intestine	Palm & Theisen et al. 2017
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	mesenteries	Kuhn et al. 2013
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	mesenteries	Kuhn et al. 2011
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Anisakidae	*Anisakis typica* var. *indonesiensis* Palm & Theisen et al., 2017	mesenteries	Palm & Theisen et al. 2017
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Nematoda**	**Camallanidae**	***Camallanus* sp.**	**intestine**	**Present study**
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Philometridae	*Philometra* sp.	stomach wall	Theisen 2009
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Nematoda**	**Philometridae**	***Philometra* sp.**	**stomach wall**	**Present study**
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Philometridae	*Philometroides trichiuri* Moravec, Walter & Yuniar, 2012	fins	Moravec et al. 2012
Perciformes	**Trichiuridae**	***Trichiurus lepturus* Linnaeus, 1758**	**Nematoda**	**Philometridae**	***Philometroides trichiuri* Moravec, Walter & Yuniar, 2012**	**fins**	**Present study**
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Philometridae	*Spirophilometra* sp.[39]	fins	Theisen 2009
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Raphidascarididae	*Raphidascaris* sp.[43]	mesenteries	Jakob & Palm 2006
Perciformes	Trichiuridae	*Trichiurus lepturus* Linnaeus, 1758	Nematoda	Raphidascarididae	*Raphidascaris* sp.[43]	mesenteries	Jakob 2005
Perciformes	Uranoscopidae	*Uranoscopus* sp.	Cestoda	Lacistorhynchidae	*Grillotia (Christianella) yuniariae* Palm, 2004	stomach wall	Palm 2004
Perciformes	Uranoscopidae	*Uranoscopus* sp.	Cestoda	Otobothriidae	*Otobothrium cysticum* (Mayer, 1842)	stomach wall	Palm 2004
Perciformes	Uranoscopidae	*Uranoscopus* spp.	Cestoda	Otobothriidae	*Symbothriorhynchus tigaminacanthus* Palm, 2004	body cavity	Palm 2004
Perciformes	Xiphiidae	*Xiphias gladius* Linnaeus, 1758	Cestoda	Gymnorhynchidae	*Molicola walteri* Palm, 2004	musculature	Palm 2004
Perciformes	Xiphiidae	*Xiphias gladius* Linnaeus, 1758	Cestoda	Sphyriocephalidae	*Hepatoxylon trichiuri* (Holten, 1802) Bosc, 1811	body cavity	Palm 2004
Perciformes	Xiphiidae	*Xiphias gladius* Linnaeus, 1758	Cestoda	Tentaculariidae	*Heteronybelinia estigmena* (Dollfus, 1960) Palm, 1999	musculature	Palm 2004
Perciformes	Xiphiidae	*Xiphias gladius* Linnaeus, 1758	Cestoda	Tentaculariidae	*Tentacularia coryphaenae* Bosc, 1802	musculature	Palm 2004
Pleuronectiformes	**Cynoglossidae**	***Cynoglossus* cf. *arel* (Bloch & Schneider, 1801)**	**Acanthocephala**	**Rhadinorhynchidae**	***Serrasentis sagittifer* (Linton, 1889)**	**mesenteries**	**Present study**
Pleuronectiformes	**Cynoglossidae**	***Cynoglossus* cf. *arel* (Bloch & Schneider, 1801)**	**Crustacea: Copepoda**	**Taeniacanthidae**	***Taeniacanthus* cf. *cynoglossi* (Rangnekar & Murti, 1962)**	**gills**	**Present study**
Pleuronectiformes	**Cynoglossidae**	***Cynoglossus* cf. *arel* (Bloch & Schneider, 1801)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study**
Pleuronectiformes	**Cynoglossidae**	***Cynoglossus* cf. *arel* (Bloch & Schneider, 1801)**	**Digenea**	**Bucephalidae**	***Prosorhynchus* sp.**	**stomach**	**Present study**
Pleuronectiformes	**Cynoglossidae**	***Cynoglossus* cf. *arel* (Bloch & Schneider, 1801)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet.**	**stomach**	**Present study**
Pleuronectiformes	**Cynoglossidae**	***Cynoglossus* cf. *arel* (Bloch & Schneider, 1801)**	**Digenea**	**Lepocreadiidae**	***Lepocreadioides* cf. *cynoglossi* Fischthal, 1970**	**stomach**	**Present study**
Pleuronectiformes	**Cynoglossidae**	***Cynoglossus* cf. *arel* (Bloch & Schneider, 1801)**	**Digenea**	**nr**	**Digenea indet. spp. (four species/morphotypes)**	**guts**	**Present study**
Pleuronectiformes	**Cynoglossidae**	***Cynoglossus* cf. *arel* (Bloch & Schneider, 1801)**	**Monogenea**	**nr**	**Monogenea indet.**	**gill cavity**	**Present study**
Pleuronectiformes	**Cynoglossidae**	***Cynoglossus* cf. *arel* (Bloch & Schneider, 1801)**	**Nematoda**	**Acuariidae**	**cf. *Paracuaria* sp.**	**intestine**	**Present study**
Pleuronectiformes	**Cynoglossidae**	***Cynoglossus* cf. *arel* (Bloch & Schneider, 1801)**	**Nematoda**	**Camallanidae**	***Procamallanus* sp.**	**intestine**	**Present study**
Pleuronectiformes	**Cynoglossidae**	***Cynoglossus* cf. *arel* (Bloch & Schneider, 1801)**	**Nematoda**	**Raphidascarididae**	***Hysterothylacium* sp.**	**mesenteries**	**Present study**
Pleuronectiformes	Cynoglossidae	*Cynoglossus* sp.	Acanthocephala	Neoechinorhynchidae	*Neoechinorhynchus longilemnicus* Yamaguti, 1954	pyloric caeca	Yamaguti 1954b
Pleuronectiformes	Cynoglossidae	*Symphurus elongatus* (Günther, 1868)	Crustacea: Copepoda	Chondracanthidae	*Scheherazade scheherazade* Leigh-Sharpe, 1934	surface	Leigh-Sharpe 1934
Pleuronectiformes	Paralichthyidae	*Pseudorhombus arsius* (Hamilton, 1822)	Cestoda	Tentaculariidae	*Heteronybelinia minima* Palm, 1999	stomach	Palm 2004

Pleuronectiformes	Paralichthyidae	*Pseudorhombus arsius* (Hamilton, 1822)	Cestoda	Tentaculariidae	*Nybelinia goreensis* Dollfuss, 1960	musculature	Palm 2004
Pleuronectiformes	Paralichthyidae	*Pseudorhombus arsius* (Hamilton, 1822)	Nematoda	Camallanidae	*Procamallanus (Spirocamallanus) spiralis* Baylis, 1922	intestine	Yamaguti 1954c
Pleuronectiformes	Paralichthyidae	*Pseudorhombus dupliciocellatus* Regan, 1905	Cestoda	Tentaculariidae	*Nybelinia goreensis* Dollfuss, 1960	musculature	Palm 2004
Pleuronectiformes	Paralichthyidae	*Pseudorhombus dupliciocellatus* Regan, 1905	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	musculature	Palm 2004
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Acanthocephala	Echinorhynchidae	*Echinorhynchus gadi*[46] Zoega in Müller, 1776	(gills)	Pardede 2000
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Cestoda	Eutetrarhynchidae	*Oncomegas javensis* Palm, 2004	body cavity	Palm 2004
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Cestoda	Lacistorhynchidae	*Pseudogilquinia thomasi* (Palm, 2000) Palm, 2004	musculature	Palm 2000
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Cestoda	Lacistorhynchidae	*Pseudogilquinia thomasi* (Palm, 2000) Palm, 2004	musculature	Palm 2004
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Cestoda	Pterobothriidae	*Pterobothrium acanthotrunctatum* Escalante & Carvajal, 1984	liver	Palm 2004
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Crustacea: Copepoda	Chondracanthidae	*Acanthochondria* sp.[55]	gills	Pardede 2000
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Crustacea: Copepoda	Chondracanthidae	*Protochondracanthus alatus* (Heller, 1865)	gills	Pardede 2000
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Crustacea: Copepoda	Chondracanthidae	*Pseudochondracanthus* sp.	gills	Pardede 2000
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Nierstrasz 1915
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Trilles 1979
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Schiødte & Meinert 1879-1884
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Crustacea: Isopoda	Gnathiidae	Gnathiidae indet.	gills	Pardede 2000
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Nematoda	Camallanidae	*Procamallanus* sp.	(gills)	Pardede 2000
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Nematoda	Philometridae	*Philometra psettoditis* Moravec, Walter & Yuniar 2012	musculature	Moravec et al. 2012
Pleuronectiformes	Psettodidae	*Psettodes erumei* (Bloch & Schneider, 1801)	Nematoda	Philometridae	*Philometra* sp.[38]	musculature	Pardede 2000
Scorpaeniformes	Peristediidae	*Satyrichthys welchi* (Herre, 1925)	Cestoda	Lacistorhynchidae	*Grillotia (Christianella) yuniariae* Palm, 2004	stomach wall	Palm 2004
Scorpaeniformes	Peristediidae	*Satyrichthys welchi* (Herre, 1925)	Cestoda	Tentaculariidae	*Nybelinia gopalai* Chandra & Rao, 1985	stomach wall	Palm 2004
Scorpaeniformes	Platycephalidae	Platycephalidae indet.	Cestoda	Eutetrarhynchidae	*Eutetrarhynchus platycephali* Palm, 2004	gills	Palm 2004
Scorpaeniformes	Platycephalidae	Platycephalidae indet.	Cestoda	Tentaculariidae	*Kotorella pronosoma* (Stossich, 1901) Euzet & Radujkovic, 1989	stomach wall	Palm 2004
Scorpaeniformes	Platycephalidae	*Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825	Acanthocephala	Cavisomidae	*Filisoma* sp.	stomach	Theisen 2009
Scorpaeniformes	Platycephalidae	*Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825	Acanthocephala	Isthmosacanthidae	*Gorgorhynchoides golvani* (Chandra et al., 1984) Bhattacharya, 2007	intestine	Theisen 2009
Scorpaeniformes	Platycephalidae	*Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825	Acanthocephala	Rhadinorhynchidae	*Serrasentis sagittifer* (Linton, 1889)	intestine	Theisen 2009
Scorpaeniformes	Platycephalidae	*Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825	Crustacea: Copepoda	Caligidae	*Caligus* sp.	gills	Theisen 2009
Scorpaeniformes	Platycephalidae	*Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus platycephali* (Yamaguti, 1939)	gills	Theisen 2009
Scorpaeniformes	Platycephalidae	*Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825	Digenea	Acanthocolpidae	*Stephanostomum* sp.	intestine	Theisen 2009
Scorpaeniformes	Platycephalidae	*Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825	Digenea	Didymozoidae	cf. *Helicodidymozoon spirale* (Yamaguti, 1938) v. *Indodid. brevicolle* (Yamaguti, 1938)	gills	Theisen 2009
Scorpaeniformes	Platycephalidae	*Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825	Digenea	Didymozoidae	Didymozoidae indet.	stomach wall	Theisen 2009
Scorpaeniformes	Platycephalidae	*Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825	Digenea	Hemiuridae	*Lecithocladium* sp.	stomach wall	Theisen 2009
Scorpaeniformes	Platycephalidae	*Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825	Digenea	Hemiuridae	*Musculovesicula* sp.	stomach wall	Theisen 2009
Scorpaeniformes	Platycephalidae	*Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Theisen 2009
Scorpaeniformes	**Platycephalidae**	***Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825**	**Nematoda**	**Camallanidae**	***Procamallanus* cf. *(Spirocamallanus) platycephali* (Hooper, 1983)**	**intestine**	**Present study, workshop Bali**
Scorpaeniformes	Platycephalidae	*Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825	Nematoda	Camallanidae	*Procamallanus* sp.[41]	intestine	Theisen 2009
Scorpaeniformes	Platycephalidae	*Platycephalus* cf. *endrachtensis* Quoy & Gaimard, 1825	Nematoda	Raphidascarididae	*Hysterothylacium* sp.	mesenteries	Theisen 2009

Scorpaeniformes	Platycephalidae	*Platycephalus indicus* (Linnaeus, 1758)	Digenea	Bucephalidae	*Prosorhynchoides tenuis* (Yamaguti, 1952) Bray & Justine, 2011	pyloric caeca	Bray et al. 2018
Scorpaeniformes	Platycephalidae	*Platycephalus indicus* (Linnaeus, 1758)	Digenea	Bucephalidae	*Prosorhynchoides tenuis* (Yamaguti, 1952) Bray & Justine, 2011	pyloric caeca	Yamaguti 1952
Scorpaeniformes	Platycephalidae	*Platycephalus indicus* (Linnaeus, 1758)	Digenea	Didymozoidae	*Helicodidymozoon spirale* (Yamaguti, 1938) Anderson & Cribb, 1994	pharynx	Yamaguti 1953b
Scorpaeniformes	Platycephalidae	*Platycephalus indicus* (Linnaeus, 1758)	Digenea	Didymozoidae	*Indodidymozoon brevicolle* (Yamaguti, 1938) Anderson & Cribb, 1994	oesophagus wall	Yamaguti 1953b
Scorpaeniformes	Platycephalidae	*Platycephalus indicus* (Linnaeus, 1758)	Monogenea	Ancyrocephalidae	*Ancyrocephalus platycephali* Yamaguti, 1953	gills	Yamaguti 1953a
Scorpaeniformes	Platycephalidae	*Sunagocia otaitensis* (Cuvier, 1829)	Digenea	Bucephalidae	*Prosorhynchus platycephali* (Yamaguti, 1934) Srivastava, 1938	intestine	Bray & Palm 2009
Scorpaeniformes	Platycephalidae	*Sunagocia otaitensis* (Cuvier, 1829)	Digenea	Bucephalidae	*Prosorhynchus platycephali* (Yamaguti, 1934) Srivastava, 1938	intestine	Bray et al. 2018
Scorpaeniformes	**Scorpaenidae**	***Dendrochirus brachypterus* (Cuvier, 1829)**	**Digenea**	**Didymozoidae**	**Didymozoidae indet.**	**body wash**	**Present study, workshop Bali**
Scorpaeniformes	**Scorpaenidae**	***Dendrochirus brachypterus* (Cuvier, 1829)**	**Myxozoa: Myxosporea**	**Kudoidae**	***Kudoa* sp.**	**stomach**	**Present study, workshop Bali**
Scorpaeniformes	Scorpaenidae	*Parascorpaena picta* (Cuvier, 1829)	Crustacea: Iopoda	Cymothoidae	*Renocila limbata* (Schiødte & Meinert, 1884)	nr	Nierstrasz 1931
Scorpaeniformes	Scorpaenidae	*Parascorpaena picta* (Cuvier, 1829)	Crustacea: Iopoda	Cymothoidae	*Renocila limbata* (Schiødte & Meinert, 1884)	nr	Sidabalok 2013
Scorpaeniformes	Scorpaenidae	*Parascorpaena picta* (Cuvier, 1829)	Crustacea: Iopoda	Cymothoidae	*Renocila limbata* (Schiødte & Meinert, 1884)	nr	Trilles 1979
Scorpaeniformes	Scorpaenidae	*Parascorpaena picta* (Cuvier, 1829)	Crustacea: Iopoda	Cymothoidae	*Renocila limbata* (Schiødte & Meinert, 1884)	nr	Schiødte & Meinert 1879-1884
Scorpaeniformes	Scorpaenidae	*Scorpaenodes guamensis* (Quoi & Gaimard, 1824)	Crustacea: Iopoda	Cymothoidae	*Renocila limbata* (Schiødte & Meinert, 1884)	nr	Sidabalok 2013
Scorpaeniformes	Scorpaenidae	*Scorpaenodes guamensis* (Quoi & Gaimard, 1824)	Crustacea: Iopoda	Cymothoidae	*Renocila limbata* (Schiødte & Meinert, 1884)	nr	Trilles 1979
Scorpaeniformes	Tetrarogidae	*Neocentropogon aeglefinus* (Weber, 1913)	Crustacea: Copepoda	Chondracanthidae	*Immanthe campanulata* Leigh-Sharpe, 1934	nr	Leigh-Sharpe 1934
Scorpaeniformes	Triglidae	*Pterygotrigla leptacanthus* (Günther, 1880)	Cestoda	Lacistorhynchidae	*Grillotia (Christianella) yuniariae* Palm, 2004	liver	Palm 2004
Scorpaeniformes	Triglidae	*Pterygotrigla leptacanthus* (Günther, 1880)	Cestoda	Lacistorhynchidae	*Pseudogrillotia multiminacantha* Palm, 2004	body cavity	Palm 2004
Siluriformes	Ariidae	*Arius* sp.	Crustacea: Iopoda	Cymothoidae	*Nerocila serra* Schiødte & Meinert, 1881	nr	Kensley 2001
Siluriformes	Ariidae	*Arius* sp.	Crustacea: Iopoda	Cymothoidae	*Nerocila serra* Schiødte & Meinert, 1881	nr	Nierstrasz 1915
Siluriformes	Ariidae	*Arius* sp.	Crustacea: Iopoda	Cymothoidae	*Nerocila serra* Schiødte & Meinert, 1881	nr	Nierstrasz 1931
Siluriformes	Ariidae	*Arius* sp.	Crustacea: Iopoda	Cymothoidae	*Nerocila serra* Schiødte & Meinert, 1881	nr	Sidabalok 2013
Siluriformes	Ariidae	*Arius* sp.	Digenea	Tandanicolidae	*Monodhelmis torpedinis* Dollfus, 1937	pyloric caeca	Yamaguti 1952
Siluriformes	Ariidae	*Arius* sp.	Digenea	Tandanicolidae	*Prosogonarium arii* Yamaguti, 1952	pyloric caeca	Yamaguti 1952
Siluriformes	Ariidae	*Arius* sp.	Monogenea	Ancylodiscoididae	*Hamatopeduncularia arii* Yamaguti, 1953	gills	Yamaguti 1953a
Siluriformes	Ariidae	*Arius* sp.	Monogenea	Ancyrocephalidae	*Metahaliotrema arii* Yamaguti, 1953	gills	Yamaguti 1953a
Siluriformes	Ariidae	*Arius* sp.	Nematoda	Ascarididae	Ascarididae indet. (as *Porrocaecum* sp.)	pyloric caeca	Yamaguti 1954c
Siluriformes	Ariidae	*Arius* sp.	Nematoda	Cucullanidae	*Cucullanus arii* Yamaguti, 1954	pyloric caeca	Yamaguti 1954c
Siluriformes	Ariidae	*Arius* sp.	Nematoda	Cucullanidae	*Cucullanus armatus* Yamaguti, 1954	pyloric caeca	Yamaguti 1954c
Siluriformes	Ariidae	*Arius* sp.	Nematoda	Raphidascarididae	*Hysterothylacium arii* (Yamaguti, 1954)	pyloric caeca	Yamaguti 1954c
Siluriformes	Ariidae	*Arius* sp.	Nematoda	Raphidascarididae	*Hysterothylacium arii* (Yamaguti, 1954)	pyloric caeca	Yamaguti 1961
Siluriformes	Ariidae	*Hexanematichthys sagor* (Hamilton, 1822)	Crustacea: Iopoda	Cymothoidae	*Renocila recta* (Nierstrasz, 1915) Bruce 1987	mouth	Bruce 1987a
Siluriformes	Ariidae	*Hexanematichthys sagor* (Hamilton, 1822)	Crustacea: Iopoda	Cymothoidae	*Renocila recta* (Nierstrasz, 1915) Bruce 1987	mouth	Nierstrasz 1915
Siluriformes	Ariidae	*Plicofollis argyropleuron* (Valenciennes, 1840)	Crustacea: Copepoda	Caligidae	*Hermilius pyriventris* Heller, 1865	gills	Heller 1865
Siluriformes	Bagridae	Bagridae indet. (as *Macrones* sp.)	Crustacea: Iopoda	Cymothoidae	*Nerocila serra* Schiødte & Meinert, 1881	nr	Kensley 2001
Siluriformes	Bagridae	Bagridae indet. (as *Macrones* sp.)	Crustacea: Iopoda	Cymothoidae	*Nerocila serra* Schiødte & Meinert, 1881	nr	Nierstrasz 1931
Siluriformes	Bagridae	Bagridae indet. (as *Macrones* sp.)	Crustacea: Iopoda	Cymothoidae	*Nerocila serra* Schiødte & Meinert, 1881	nr	Sidabalok 2013
Siluriformes	Bagridae	Bagridae indet. (as *Macrones* sp.)	Crustacea: Iopoda	Cymothoidae	*Nerocila serra* Schiødte & Meinert, 1881	nr	Trilles 1979
Siluriformes	nr	Siluriformes indet. (as American freshwater sp.)	Crustacea: Copepoda	Caligidae	*Parapetalus orientalis* Steenstrup & Lütken, 1861	gills	Heller 1865

Siluriformes	Plotosidae	*Plotosus lineatus* (Thunberg, 1787)	Crustacea: Copepoda	Taeniacanthidae	*Irodes remipes* Dojiri & Cressey, 1987	nr (gill cavity)	Dojiri & Cressey 1987
Siluriformes	Plotosidae	*Plotosus lineatus* (Thunberg, 1787)	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus anguillaris* (Devi & Shayamasundari, 1980)	nr (gill cavity)	Dojiri & Cressey 1987
Stomiiformes	Sternoptychidae	*Polyipnus spinosus* Günther, 1887	Crustacea: Copepoda	Pennellidae	*Protosarcotretes gnavus* (Leigh-Sharpe, 1934)	nr	Leigh-Sharpe 1934
Stomiiformes	Sternoptychidae	Sternoptychidae indet.	Cestoda	Lacistorhynchidae	*Grillotia (Christianella) yuniariae* Palm, 2004	body cavity	Palm 2004
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Acanthocephala	Echinorhynchidae	*Acanthocephalus lucii*[44]	intestine	Desrina 2007
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Acanthocephala	Echinorhynchidae!	*Anisakis* spp.[45] (Acanthocephala according to figure!)	intestine	Zarry et al. 2017
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Cestoda	(Tetraphyllidea)	Tetraphyllidea indet.	stomach	Zarry et al. 2017
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Crustacea: Isopoda	Cymothoidae	*Ourozeuktes bopyroides* (Lesueur, 1814)	surface (near anus)	Monod & Serène 1976
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Crustacea: Isopoda	Cymothoidae	*Ourozeuktes bopyroides* (Lesueur, 1814)	surface (near anus)	Monod 1976
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Nematoda	Acanthocheilidae	*Pseudanisakis* sp.	mesenteries	Desrina 2007
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Nematoda	Anisakidae	*Anisakis simplex*[30] (Rudolphi, 1809)	mesenteries	Desrina 2007
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Nematoda	Anisakidae	*Anisakis* sp.[30]	mesenteries	Desrina 2007
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Nematoda	Camallanidae	*Camallanus* sp.	intestine	Desrina 2007
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Nematoda	Camallanidae	*Procamallanus* sp.	intestine	Desrina 2007
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Nematoda	Cucullanidae	*Cucullanus* sp.	intestine	Desrina 2007
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Nematoda	Gnathostomatidae	*Echinocephalus* sp.	nr	Desrina 2007
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Nematoda	Philometridae	*Philometra sanguinea* (Rudolphi, 1819)	nr	Desrina 2007
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Nematoda	Philometridae	*Philometra* sp.[29]	nr	Desrina 2007
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Nematoda	Raphidascarididae	*Contracaecum* & *Porrocaecum* sp.[28]	intestine	Desrina 2007
Tetraodontiformes	Balistidae	*Abalistes stellaris* (Bloch & Schneider, 1801)	Nematoda	Raphidascarididae	*Raphidascaris* sp.	mesenteries	Desrina 2007
Tetraodontiformes	Balistidae	*Balistapus undulatus* (Park, 1797)	Digenea	Lepocreadiidae	*Balistovermis lombokensis* Machida, 2011	intestine	Machida 2011
Tetraodontiformes	Balistidae	*Balistes* sp.	Crustacea: Iopoda	Cymothoidae	*Anilocra amboinensis* Schiødte & Meinert, 1881	nr	Bleeker 1857
Tetraodontiformes	Balistidae	*Balistes* sp.	Crustacea: Iopoda	Cymothoidae	*Anilocra amboinensis* Schiødte & Meinert, 1881	nr	Nierstrasz 1915
Tetraodontiformes	Balistidae	*Balistes* sp.	Crustacea: Iopoda	Cymothoidae	*Anilocra amboinensis* Schiødte & Meinert, 1881	nr	Nierstrasz 1931
Tetraodontiformes	Balistidae	*Balistes* sp.	Crustacea: Iopoda	Cymothoidae	*Anilocra amboinensis* Schiødte & Meinert, 1881	nr	Sidabalok 2013
Tetraodontiformes	Balistidae	*Balistes* sp.	Crustacea: Iopoda	Cymothoidae	*Anilocra rhodotaenia* Bleeker, 1857	surface	Bleeker 1857
Tetraodontiformes	Balistidae	*Balistes* sp.	Crustacea: Iopoda	Cymothoidae	*Anilocra rhodotaenia* Bleeker, 1857	surface	Nierstrasz 1931
Tetraodontiformes	Balistidae	*Balistes* sp.	Crustacea: Iopoda	Cymothoidae	*Anilocra rhodotaenia* Bleeker, 1857	surface	Sidabalok 2013
Tetraodontiformes	Balistidae	*Balistoides* sp. (in freshwater)	Crustacea: Copepoda	Caligidae	*Lepeophtheirus* cf. *brachyurus* Heller, 1865 (in freshwater)	nr	Zafran et al. 1998
Tetraodontiformes	**Balistidae**	***Sufflamen fraenatum* (Latreille, 1804)**	**Crustacea: Isopoda**	**Gnathiidae**	**Gnathiidae indet.**	**gills**	**Present study, workshop Bali**
Tetraodontiformes	**Balistidae**	***Sufflamen fraenatum* (Latreille, 1804)**	**Digenea**	**Lepocreadiidae**	***Hypocreadium* cf. *balistes* (Nagaty, 1942) Bray & Cribb, 1996**	**gills**	**Present study, workshop Bali**
Tetraodontiformes	Balistidae	*Sufflamen fraenatum* (Latreille, 1804)	Nematoda	Anisakidae	*Anisakis* sp. "HC-2005"	guts	Palm & Theisen et al. 2017, workshop
Tetraodontiformes	**Balistidae**	***Sufflamen fraenatum* (Latreille, 1804)**	**Nematoda**	**Anisakidae**	***Terranova* sp.**	**guts**	**Present study, workshop Bali**
Tetraodontiformes	Diodontidae	*Diodon hystrix* Linnaeus, 1758	Cestoda	Gymnorhynchidae	*Molicola horridus* (Goodsir, 1841) Dollfus, 1935	liver	Palm 2004
Tetraodontiformes	Diodontidae	*Diodon hystrix* Linnaeus, 1758	Cestoda	Lacistorhynchidae	*Floriceps saccatus* Cuvier, 1817	body cavity	Palm 2004
Tetraodontiformes	Diodontidae	*Diodon hystrix* Linnaeus, 1758	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	oesophagus	Palm 2004
Tetraodontiformes	Diodontidae	*Diodon liturosus* Shaw, 1804	Cestoda	Tentaculariidae	*Nybelinia indica* Chandra, 1986	stomach wall	Palm 2004
Tetraodontiformes	Diodontidae	Diodontidae indet.	Cestoda	Tentaculariidae	*Kotorella pronosoma* (Stossich, 1901) Euzet & Radujkovic, 1989	stomach wall	Palm 2004
Tetraodontiformes	Monacanthidae	*Aluterus monoceros* (L.)	Cestoda	Pseudotobothriidae	*Parotobothrium balli* (Southwell, 1929) Palm, 2004	body cavity	Palm 2004
Tetraodontiformes	Monacanthidae	*Aluterus monoceros* (L.)	Cestoda	Tentaculariidae	*Heteronybelinia estigmena* (Dollfus, 1960) Palm, 1999	stomach wall	Palm 2004

Tetraodontiformes	**Monacanthidae**	***Aluterus monoceros* (L.)**	**Crustacea: Copepoda**	**nr**	**Copepoda indet.**	**gills**	**Present study, workshop Bali**
Tetraodontiformes	**Monacanthidae**	***Aluterus monoceros* (L.)**	**Digenea**	**Accacoeliidae**	***Tetrochetus* cf. *aluterae* (Hanson, 1955)**	**guts**	**Present study, workshop Bali**
Tetraodontiformes	**Monacanthidae**	***Aluterus monoceros* (L.)**	**Digenea**	**Hemiuridae**	***Erilepturus neopacificus* (Velasquez, 1962)**	**guts**	**Present study, workshop Bali**
Tetraodontiformes	**Monacanthidae**	***Aluterus monoceros* (L.)**	**Digenea**	**Lecithasteridae**	***Aponurus* sp.**	**guts**	**Present study, workshop Bali**
Tetraodontiformes	Monacanthidae	*Aluterus scriptus* (Osbeck, 1765)	Crustacea: Copepoda	Taeniacanthidae	*Taeniacanthus similis* Dojiri & Cressey, 1987	nr	Dojiri & Cressey 1987
Tetraodontiformes	Ostraciidae	*Ostracion meleagris* Shaw, 1796	Crustacea: Copepoda	Pennellidae	*Peniculisa furcata* (Krøyer, 1863)	nr	Leigh-Sharpe 1934
Tetraodontiformes	Tetraodontidae	*Arothron immaculatus* (Bloch & Schneider, 1801)	Nematoda	Philometridae	*Philometra javensis* Moravec, Walter & Yuniar, 2012	body cavity	Moravec et al. 2012
Tetraodontiformes	Tetraodontidae	*Arothron manilensis* (Marion de Procé, 1822)	Digenea	Aporocotylidae	*Psettarium pulchellum* Yong et al., 2016	heart	Yong et al. 2016, workshop Bali
Tetraodontiformes	**Tetraodontidae**	***Arothron manilensis* (Marion de Procé, 1822)**	**Myxozoa: Myxosporea**	**Ceratomyxidae**	***Ceratomyxa* sp.**	**gallbladder**	**Present study, workshop Bali**
Tetraodontiformes	**Tetraodontidae**	***Arothron manilensis* (Marion de Procé, 1822)**	**Myxozoa: Myxosporea**	**Myxidiidae**	***Myxidium* sp.**	**gallbladder**	**Present study, workshop Bali**
Tetraodontiformes	**Tetraodontidae**	***Arothron manilensis* (Marion de Procé, 1822)**	**Myxozoa: Myxosporea**	**Myxobolidae**	***Myxobolus* sp.**	**gills**	**Present study, workshop Bali**
Tetraodontiformes	**Tetraodontidae**	***Arothron manilensis* (Marion de Procé, 1822)**	**Myxozoa: Myxosporea**	**Ortholineidae**	***Ortholinea* sp.**	**urinary bladder**	**Present study, workshop Bali**
Tetraodontiformes	**Tetraodontidae**	***Arothron manilensis* (Marion de Procé, 1822)**	**Myxozoa: Myxosporea**	**Sphaerosporidae**	***Sphaerospora* sp.**	**urinary bladder**	**Present study, workshop Bali**
Tetraodontiformes	**Tetraodontidae**	***Arothron reticularis* (Bloch & Schneider, 1801)**	**Crustacea: Copepoda**	**Caligidae**	***Lepeophtheirus* cf. *brachyurus* Heller, 1865**	**gills**	**Present study, workshop Bali**
Tetraodontiformes	**Tetraodontidae**	***Arothron reticularis* (Bloch & Schneider, 1801)**	**Crustacea: Copepoda**	**Hatschekiidae**	***Hatschekia* sp.**	**gills**	**Present study, workshop Bali**
Tetraodontiformes	Tetraodontidae	*Arothron reticularis* (Bloch & Schneider, 1801)	Digenea	Aporocotylidae	*Psettarium jimbaranense* Yong et al., 2016	heart	Yong et al. 2016, workshop Bali
Tetraodontiformes	Tetraodontidae	*Arothron reticularis* (Bloch & Schneider, 1801)	Digenea	Aporocotylidae	*Psettarium ogawai* Yong et al., 2016	heart	Yong et al. 2016, workshop Bali
Tetraodontiformes	**Tetraodontidae**	***Arothron reticularis* (Bloch & Schneider, 1801)**	**Myxozoa: Myxosporea**	**Myxidiidae**	***Myxidium* sp.**	**gallbladder**	**Present study, workshop Bali**
Tetraodontiformes	Tetraodontidae	*Arothron stellatus* (Anonymous, 1798)	Crustacea: Copepoda	Caligidae	*Lepeophtheirus brachyurus* Heller, 1865	gills	Heller 1865
Tetraodontiformes	Tetraodontidae	*Arothron stellatus* (Anonymous, 1798)	Nematoda	Philometridae	*Philometra pellucida* (Jägerskiöld, 1893)	body cavity	Dewi & Palm 2013
Tetraodontiformes	Tetraodontidae	*Arothron stellatus* (Anonymous, 1798)	Nematoda	Philometridae	*Philometra pellucida* (Jägerskiöld, 1893)	body cavity	Jägerskiöld 1893
Tetraodontiformes	Tetraodontidae	*Arothron stellatus* (Anonymous, 1798)	Nematoda	Philometridae	*Philometra pellucida* (Jägerskiöld, 1893)	body cavity	Jägerskiöld 1894
Tetraodontiformes	Tetraodontidae	*Arothron stellatus* (Anonymous, 1798)	Nematoda	Philometridae	*Philometra pellucida* (Jägerskiöld, 1893)	body cavity	Moravec 2006
Tetraodontiformes	Tetraodontidae	*Arothron stellatus* (Anonymous, 1798)	Nematoda	Philometridae	*Philometra pellucida* (Jägerskiöld, 1893)	body cavity	Moravec et al. 2012
Tetraodontiformes	Tetraodontidae	cf. *Tetrodon* v. *Tetraodon* sp.	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Nierstrasz 1931
Tetraodontiformes	Tetraodontidae	cf. *Tetrodon* v. *Tetraodon* sp.	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Sidabalok 2013
Tetraodontiformes	Tetraodontidae	cf. *Tetrodon* v. *Tetraodon* sp.	Crustacea: Isopoda	Cymothoidae	*Cymothoa eremita* (Brunnich, 1783)	mouth	Trilles 1979
Tetraodontiformes	Tetraodontidae	*Mola mola* (Linnaeus, 1758)	Cestoda	Gymnorhynchidae	*Molicola horridus* (Goodsir, 1841) Dollfus, 1935	liver	Palm 2004
Tetraodontiformes	Tetraodontidae	*Mola mola* (Linnaeus, 1758)	Cestoda	Gymnorhynchidae	*Molicola uncinatus* (Linton, 1924)	liver	Palm 2004
Tetraodontiformes	**Tetraodontidae**	***Tylerius spinosissimus* (Regan, 1908)**	**Crustacea: Copepoda**	**Caligidae**	**Caligidae indet.**	**surface**	**Present study, workshop Bali**
Tetraodontiformes	**Tetraodontidae**	***Tylerius spinosissimus* (Regan, 1908)**	**Crustacea: Copepoda**	**Chondracanthidae**	**Chondracanthidae indet.**	**mouth**	**Present study, workshop Bali**
Tetraodontiformes	**Tetraodontidae**	***Tylerius spinosissimus* (Regan, 1908)**	**Myxozoa: Myxosporea**	**Myxidiidae**	***Myxidium* sp.**	**gallbladder**	**Present study, workshop Bali**
Tetraodontiformes	Tetraodontidae	*Tylerius spinosissimus* (Regan, 1908)	Nematoda	Philometridae	*Philometra damriyasai* Dewi & Palm, 2017	body cavity	Dewi & Palm 2017
	`jellyfish´	`jellyfish´	Crustacea: Isopoda	Cymothoidae	*Aegathoa macrophthalma*[56] Dana, 1853 *nomen dubium*	nr	Trilles & Öktener 2004
		without host	Crustacea: Copepoda	Bomolochidae	*Bomolochus efficatus* Leigh-Sharpe, 1934 *taxon inquirendum*	nr	Leigh-Sharpe 1930
		without host	Crustacea: Copepoda	Caligidae	*Caligus coryphaenae* Steenstrup & Lütken, 1861	nr	Heegaard 1972
		without host	Crustacea: Copepoda	Caligidae	*Euryphorus brachypterus* (Gerstaecker, 1853)	nr	Heegaard 1972
		without host	Crustacea: Copepoda	Chondracanthidae	*Ceratochondria brevicollis* (Krøyer, 1863)	nr	Krøyer 1863
		without host	Crustacea: Copepoda	Ergasilidae	*Ergasilus borneoensis* Yamaguti, 1954	nr	Kabata 1985
		without host	Crustacea: Copepoda	Ergasilidae	*Ergasilus borneoensis* Yamaguti, 1954	nr	Yamaguti 1954d

without host	Crustacea: Iopoda	Aegidae	*Aega antennata* Richardson, 1910	nr	Richardson 1910
without host	Crustacea: Iopoda	Aegidae	*Aega antennata* Richardson, 1910	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Aegidae	*Aega vigilans* (Haswell, 1881) *nomen dubium*	nr	Nierstrasz 1931
without host	Crustacea: Iopoda	Aegidae	*Aega vigilans* (Haswell, 1881) *nomen dubium*	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Aegidae	*Aega whanui* Bruce, 2009	nr	Bruce 2009
without host	Crustacea: Iopoda	Aegidae	*Aega whanui* Bruce, 2009	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Aegidae	*Aegapheles banda* (Bruce, 2004)	nr	Bruce 2004
without host	Crustacea: Iopoda	Aegidae	*Aegapheles banda* (Bruce, 2004)	nr	Bruce 2009
without host	Crustacea: Iopoda	Aegidae	*Aegapheles banda* (Bruce, 2004)	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Aegidae	*Aegiochus coroo* (Bruce, 1983)	nr	Bruce 2009
without host	Crustacea: Iopoda	Aegidae	*Aegiochus coroo* (Bruce, 1983)	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Aegidae	*Aegiochus plebeia* (Hansen, 1897)	nr	Bruce 2009
without host	Crustacea: Iopoda	Aegidae	*Aegiochus plebeia* (Hansen, 1897)	nr	Nierstrasz 1931
without host	Crustacea: Iopoda	Aegidae	*Aegiochus plebeia* (Hansen, 1897)	nr	Richardson 1910
without host	Crustacea: Iopoda	Aegidae	*Aegiochus plebeia* (Hansen, 1897)	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Aegidae	*Aegiochus* spp. nov. (two new species)	nr	Bruce 2009
without host	Crustacea: Iopoda	Aegidae	*Aegiochus* spp. nov. (two new species)	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Aegidae	*Aegiochus vigilans* (Haswell, 1881)	nr	Bruce 2009
without host	Crustacea: Iopoda	Aegidae	*Aegiochus weberi* (Nierstrasz, 1931)	nr	Bruce 2009
without host	Crustacea: Iopoda	Aegidae	*Aegiochus weberi* (Nierstrasz, 1931)	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Aegidae	*Rocinela media* Nierstrasz, 1931	nr	Bruce 2009
without host	Crustacea: Iopoda	Aegidae	*Rocinela media* Nierstrasz, 1931	nr	Nierstrasz 1931
without host	Crustacea: Iopoda	Aegidae	*Rocinela media* Nierstrasz, 1931	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Aegidae	*Rocinela orientalis* Schioedte & Meinert, 1879	nr	Bruce 2009
without host	Crustacea: Iopoda	Aegidae	*Rocinela richardsonae* Nierstrasz, 1931	nr	Bruce 2009
without host	Crustacea: Iopoda	Aegidae	*Rocinela richardsonae* Nierstrasz, 1931	nr	Nierstrasz 1931
without host	Crustacea: Iopoda	Aegidae	*Rocinela richardsonae* Nierstrasz, 1931	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Aegidae	*Syscenus infelix* Harger, 1880	nr	Richardson 1910
without host	Crustacea: Iopoda	Aegidae	*Syscenus infelix* Harger, 1880	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Aegidae	*Syscenus intermedius* Richardson 1910	nr	Richardson 1910
without host	Crustacea: Iopoda	Aegidae	*Syscenus intermedius* Richardson 1910	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Aegidae	*Syscenus latus* Richardson 1909	nr	Richardson 1910
without host	Crustacea: Iopoda	Aegidae	*Syscenus latus* Richardson 1909	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Ceratothoa gaudichaudii* (H. Milne Edwards, 1840) *taxon inquirendum*	nr	Nierstrasz 1931
without host	Crustacea: Iopoda	Cymothoidae	*Ceratothoa imbricata* (Fabricius, 1775)	nr	Kensley 2001
without host	Crustacea: Iopoda	Cymothoidae	*Ceratothoa imbricata* (Fabricius, 1775)	nr	Nierstrasz 1931
without host	Crustacea: Iopoda	Cymothoidae	*Ceratothoa imbricata* (Fabricius, 1775)	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Ceratothoa imbricata* (Fabricius, 1775)	nr	Schiødte & Meinert 1879-1884
without host	Crustacea: Iopoda	Cymothoidae	*Ceratothoa trigonocephala* (Leach, 1818)	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Ceratothoa verrucosa* (Schiødte & Meinert, 1883)	nr	Nierstrasz 1931

without host	Crustacea: Iopoda	Cymothoidae	*Ceratothoa verrucosa* (Schiødte & Meinert, 1883)	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Cymothoa eximia* Schiødte & Meinert, 1884	nr	Nierstrasz 1931
without host	Crustacea: Iopoda	Cymothoidae	*Cymothoa eximia* Schiødte & Meinert, 1884	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Cymothoa eximia* Schiødte & Meinert, 1884	nr	Schiødte & Meinert 1879-1884
without host	Crustacea: Iopoda	Cymothoidae	*Cymothoa indica* Schiødte & Meinert, 1884	nr	Nierstrasz 1931
without host	Crustacea: Iopoda	Cymothoidae	*Cymothoa marginata* Bleeker, 1857	nr	Bleeker 1857
without host	Crustacea: Iopoda	Cymothoidae	*Cymothoa marginata* Bleeker, 1857	nr	Miers 1880
without host	Crustacea: Iopoda	Cymothoidae	*Cymothoa marginata* Bleeker, 1857	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Cymothoa pulchrum* Lancaster, 1902	nr	Kensley 2001
without host	Crustacea: Iopoda	Cymothoidae	*Cymothoa pulchrum* Lancaster, 1902	nr	Monod 1924
without host	Crustacea: Iopoda	Cymothoidae	*Cymothoa pulchrum* Lancaster, 1902	nr	Nierstrasz 1915
without host	Crustacea: Iopoda	Cymothoidae	*Cymothoa pulchrum* Lancaster, 1902	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Elthusa intermedia* (Nierstrasz, 1937) Bruce, 1990	nr	Nierstrasz 1931
without host	Crustacea: Iopoda	Cymothoidae	*Elthusa intermedia* (Nierstrasz, 1937) Bruce, 1990	nr	Bruce 1990
without host	Crustacea: Iopoda	Cymothoidae	*Elthusa intermedia* (Nierstrasz, 1937) Bruce, 1990	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Elthusa nierstraszi* Hadfield, Bruce & Smit, 2016	nr	Nierstrasz 1915
without host	Crustacea: Iopoda	Cymothoidae	*Elthusa nierstraszi* Hadfield, Bruce & Smit, 2016	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Enispa irregularis* (Bleeker, 1857)	nr	Bleeker 1857
without host	Crustacea: Iopoda	Cymothoidae	*Enispa irregularis* (Bleeker, 1857)	nr	Bruce 1990
without host	Crustacea: Iopoda	Cymothoidae	*Enispa irregularis* (Bleeker, 1857)	nr	Nierstrasz 1915
without host	Crustacea: Iopoda	Cymothoidae	*Enispa irregularis* (Bleeker, 1857)	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Enispa irregularis* (Bleeker, 1857)	nr	Trilles 1979
without host	Crustacea: Iopoda	Cymothoidae	*Ichthyoxenos jellinghausii* Herklots, 1870	nr	Nierstrasz 1931
without host	Crustacea: Iopoda	Cymothoidae	*Ichthyoxenos jellinghausii* Herklots, 1870	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Mothocya melanosticta* (Schioedte & Meinert, 1884)	nr	Nierstrasz 1931
without host	Crustacea: Iopoda	Cymothoidae	*Mothocya melanosticta* (Schioedte & Meinert, 1884)	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Mothocya plagulophora* (Haller, 1880)	nr	Nierstrasz 1931
without host	Crustacea: Iopoda	Cymothoidae	*Mothocya plagulophora* (Haller, 1880)	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Nerocila exocoeti* Pilai, 1854	nr	Bruce & Harrison-Nelson 1988
without host	Crustacea: Iopoda	Cymothoidae	*Nerocila exocoeti* Pilai, 1854	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Nerocila laevinotum* Miers *nomen dubium*	nr	Nierstrasz 1931
without host	Crustacea: Iopoda	Cymothoidae	*Nerocila loveni* Bovallius, 1887	nr	Bovallius 1886
without host	Crustacea: Iopoda	Cymothoidae	*Nerocila loveni* Bovallius, 1887	nr	Nierstrasz 1915
without host	Crustacea: Iopoda	Cymothoidae	*Nerocila loveni* Bovallius, 1887	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Nerocila loveni* Bovallius, 1887	nr	Stebbing 1893
without host	Crustacea: Iopoda	Cymothoidae	*Nerocila loveni* Bovallius, 1887	nr	Trilles 1979
without host	Crustacea: Iopoda	Cymothoidae	*Nerocila monodi* Hale, 1940	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Nerocila trivittata* Bleeker, 1857	nr	Bleeker 1857
without host	Crustacea: Iopoda	Cymothoidae	*Plotor indus* Schiødte & Meinert, 1881	nr	Schiødte & Meinert 1879-1884
without host	Crustacea: Iopoda	Cymothoidae	*Renocila indica* Schiødte & Meinert, 1884	nr	Nierstrasz 1931

without host	Crustacea: Iopoda	Cymothoidae	*Renocila indica* Schiødte & Meinert, 1884	nr	Sidabalok 2013
without host	Crustacea: Iopoda	Cymothoidae	*Renocila indica* Schiødte & Meinert, 1884	nr	Trilles1979
without host	Crustacea: Iopoda	Cymothoidae	*Renocila indica* Schiødte & Meinert, 1884	nr	Schiødte & Meinert 1879-1884
without host	Crustacea: Iopoda	Cymothoidae	*Telotha indica* Nierstrasz, 1915	nr	Nierstrasz 1915
without host	Crustacea: Iopoda	Cymothoidae	*Telotha indica* Nierstrasz, 1915	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Barybrotidae	*Barybrotes indus*[58] Schiødte & Meinert, 1879	nr	Nierstrasz 1931
without host	Crustacea: Isopoda	Barybrotidae	*Barybrotes indus*[58] Schiødte & Meinert, 1879	nr	Schiødte & Meinert 1879-1884
without host	Crustacea: Isopoda	Corallanidae	*Alcirona indica* Nierstrasz, 1931	nr	Nierstrasz 1931
without host	Crustacea: Isopoda	Corallanidae	*Alcirona indica* Nierstrasz, 1931	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Corallanidae	*Alcirona niponia* Richardson, 1909	nr	Nierstrasz 1931
without host	Crustacea: Isopoda	Corallanidae	*Alcirona niponia* Richardson, 1909	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Corallanidae	*Alcirona papuana* Nobili, 1905	nr	Nobili 1905
without host	Crustacea: Isopoda	Corallanidae	*Alcirona papuana* Nobili, 1905	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Corallanidae	*Argathona stebbingi* Nierstrasz, 1931	nr	Delaney 1989
without host	Crustacea: Isopoda	Corallanidae	*Argathona stebbingi* Nierstrasz, 1931	nr	Nierstrasz 1931
without host	Crustacea: Isopoda	Corallanidae	*Argathona stebbingi* Nierstrasz, 1931	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Cymothoidae	*Aegathoa buitendijki*[56] Nierstrasz, 1915 *nomen dubium*	nr	Nierstrasz 1915
without host	Crustacea: Isopoda	Cymothoidae	*Aegathoa buitendijki*[56] Nierstrasz, 1915 *nomen dubium*	nr	Nierstrasz 1931
without host	Crustacea: Isopoda	Cymothoidae	*Aegathoa buitendijki*[56] Nierstrasz, 1915 *nomen dubium*	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Cymothoidae	*Amblycephalon schadleri* (Nierstrasz, 1915)	nr	Bruce 1987b
without host	Crustacea: Isopoda	Cymothoidae	*Amblycephalon schadleri* (Nierstrasz, 1915)	nr	Nierstrasz 1915
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra capensis* Leach, 1818	nr	Bruce & Harrison-Nelson 1988
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra capensis* Leach, 1818	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra capensis* Leach, 1818	nr	Stebbing 1900
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra capensis* Leach, 1818	nr	Trilles 1975
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra capensis* Leach, 1818	nr	Schiødte & Meinert 1879-1884
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra cavicauda* Richardson, 1910	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra gigantea* (Herklots, 1870)	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra koolanae* Bruce, 1987	nr	Bruce & Harrison-Nelson 1988
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra koolanae* Bruce, 1987	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra leptosoma* Bleeker, 1857	nr	Bleeker 1857
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra leptosoma* Bleeker, 1857	nr	Kensley 2001
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra leptosoma* Bleeker, 1857	nr	Monod 1933/4
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra leptosoma* Bleeker, 1857	nr	Nierstrasz 1931
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra leptosoma* Bleeker, 1857	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra leptosoma* Bleeker, 1857	nr	Trilles 1979
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra leptosoma* Bleeker, 1857	nr	Schiødte & Meinert 1879-1884
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra longicauda* Schiødte & Meinert, 1881	nr	Bruce 1987c
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra longicauda* Schiødte & Meinert, 1881	nr	Nierstrasz 1915
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra longicauda* Schiødte & Meinert, 1881	nr	Sidabalok 2013

without host	Crustacea: Isopoda	Cymothoidae	*Anilocra marginata* (Bleeker, 1857)	nr	Bleeker 1857
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra marginata* (Bleeker, 1857)	nr	Bruce & Harrison-Nelson 1988
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra marginata* (Bleeker, 1857)	nr	Nierstrasz 1931
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra marginata* (Bleeker, 1857)	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra recta* Nierstrasz, 1915	nr	Nierstrasz 1931
without host	Crustacea: Isopoda	Cymothoidae	*Anilocra recta* Nierstrasz, 1915	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Cymothoidae	*Catoessa boscii* (Bleeker, 1857)	surface	Bleeker 1857
without host	Crustacea: Isopoda	Cymothoidae	*Catoessa boscii* (Bleeker, 1857)	surface	Nierstrasz 1931
without host	Crustacea: Isopoda	Cymothoidae	*Catoessa boscii* (Bleeker, 1857)	surface	Sidabalok 2013
without host	Crustacea: Isopoda	Cymothoidae	*Catoessa boscii* (Bleeker, 1857)	surface	Trilles 1979
without host	Crustacea: Isopoda	Cymothoidae	*Catoessa boscii* (Bleeker, 1857)	surface	Schiødte & Meinert 1879-1884
without host	Crustacea: Isopoda	Cymothoidae	*Catoessa scabricauda* Schiødte & Meinert, 1884	nr	Nierstrasz 1931
without host	Crustacea: Isopoda	Cymothoidae	*Catoessa scabricauda* Schiødte & Meinert, 1884	nr	Sidabalok 2013
without host	Crustacea: Isopoda	Cymothoidae	*Catoessa scabricauda* Schiødte & Meinert, 1884	nr	Schiødte & Meinert 1879-1884
without host	Crustacea: Isopoda	Cymothoidae	*Norileca indica* (H. Milne Edwards, 1840)	nr	Milne Edwards 1840
without host	Crustacea: Isopoda	Cymothoidae	*Norileca indica* (H. Milne Edwards, 1840)	nr	Trilles 1979
without host	Crustacea: Isopoda	Gnathiidae	*Elaphognathia rangifer* Monod, 1926	nr	Monod 1926
without host	Crustacea: Isopoda	Gnathiidae	*Elaphognathia rangifer* Monod, 1926	nr	Sidabalok 2013
without host	Digenea	Cryptogonimidae	*Neometadena ovata* (Yamaguti, 1952) Miller & Cribb, 2008	nr	Yamaguti 1952
without host	Hirudinea	Piscicolidae	*Stibarobdella macrothela* (Schmarda, 1861) (known from sharks/rays)	nr	Blanchard 1897

11. Appendix I.2: Annotations to Checklist

Additionally to the summaries of the checklist in the introduction and discussion parts above, further remarks to the species identifications (marked with blue colour in the list above) are given below.

Myxozoa:

[1]Myxozoa indet. from the gallbladder of serranid hosts are suggested to represent *Ceratomyxa* sp. (because it is known from this hosts and organ from Indonesia)

Digenea:

[2]*Bivesicula* sp. from synodontid host is suggested to represent *B. synodi* (regarding to its host specificity)

[3]*Prosorhynchus* sp. from *Epinephelus sexfasciatus* was sighted and corrected to *Prosorhynchus luzonicus*

[4]*Alcicornis* sp. from scombrid host is suggested to represent *Alcicornis scomberi* (regarding to its host specificity)

[5]*Echinostoma* sp. material from *Megalaspis cordyla* was sighted and corrected to *Bucephalus fragilis*

[6]Digenea indet. material from *Lutjanus vitta* was sighted and corrected to *Euryakaina manilensis*

[7]*Didymodiclinus* sp. and *Didymodiclinus* cf. *epinepheli* from *Epinephelus areolatus*, *E. coioides*, *E. corallicola*, *E. quoyanus*, *Cephalopholis miniata* and *Variola albimarginata* are suggested to rather represent *Didymodiclinus epinepheli*, or *Allonematobothrium epinepheli*, as identified by Neubert (2016a, b) from the same site and fish (both are host specific)

[8]One of the *Didymosulcus* spp. from *Thunnus albacares* and *T. obesus* is suggested to represent *Didymosulcus philobranchia*, as identified from the same host and site on the First Educational Workshop on Marine Fish Parasites in Indonesia, Bali, 2013

[9]The *Koellikeria* sp. from the stomachs of *Thunnus albacares* and *T. obesus* are suggested to represent *Koellikeria orientalis*, as identified from the same host and site on the First Educational Workshop on Marine Fish Parasites in Indonesia, Bali, 2013

[10 & 11]The haploporids Haploporidae indet. and *Lecithobotrys* sp. from *Mugil cephalus* are suggested to represent the two species *Haploporus magnisaccus* and *Pseudolecithobotrys stomachicola*, both originally described from this host in Indonesia (Machida 1996)

[12]*Lecithochirium* sp. from *Epinephelus coioides* rather represents *Lecithochirium magnaporum*, as recorded for this host from Indonesian aquaculture, and for other free-living Indonesian groupers

[13]*Lecithocladium* sp. from *Parastromateus niger* was sighted and corrected to *Lecithocladium apolecti*, also recorded for this host on the First Educational Workshop on Marine Fish Parasites in Indonesia, Bali, 2013

[14]*Lecithochirium* sp. from *Priacanthus tayenus* was sighted and corrected to *Lecithochirium* cf. *priacanthi* (host specific)

[15]*Lecithocladium* sp., sp. 1 and sp. 2 from *Rastrelliger kanagurta* were sighted and corrected to *L. angustiovum* and *L. parviovum*; both species were originally described from this host in Indonesia (Yamaguti 1953b), and were recorded by the author

[16]*Lecithochirium* sp. from *Trichiurus lepturus* was sighted and corrected to *Lecithochirium trichiuri*, as recorded for this host in the region by various authors, including the author of this dissertation (it is known to be host specific)

[17]*Prodistomum* sp. from *Rastrelliger brachysoma* and *R. kanagurta* is suggested to represent *Prodistomum orientale*, as recorded for this host in the region

[18]*Opisthomonorcheides* sp. from *Parastromateus niger* is suggested to represent *O. pampi* or *O. ovacutus*, as recorded for this host in the region (*Parastromateus niger* shows similarities with *Pampus argenteus* in its appearance and shape, and Indonesian common fish names are similar (`Bawal´))

[19]*Helicometra* sp. from *Epinephelus sexfasciatus* was sighted and corrected to *Helicometra* cf. *fasciata*, as recorded for this host in the region by the author (and probably for *Lutjanus vitta*)

[20]Oepecoelide indet. from *Johnius coitor* might represent *Helicometrina* sp. as recorded for other sciaenids in the region

[21]*Pseudopecoeloides* sp. from *Priacanthus macracanthus* is suggested to represent *Pseudopecoeloides tenuis*, as recorded by various authors (including this thesis' author) for host congener in the region

[22]*Prosorchis* sp. from *Pampus argenteus* was sighted and corrected to *Prosorchis pampi* (host specific)

Monogenea:

[23]Diclidophoridae indet. from *Selar boops* and *S. crumenophthalmus* were sighted and corrected to cf. *Amphipolycotyle chloroscombrus*

[24]*Haliotrema* sp. from *Epinephelus sexfasciatus* was sighted and corrected to *Haliotrema epinepheli*

[25]*Dactylogyrus/Gyrodactylus* from *Rastrelliger brachysoma* are suggested to be misidentifications because genera seem to not infect Indonesian marine fish

[26]Microcotyloidea indet. from *Johnius borneensis* was sighted and corrected to *Pseudempleurosoma haywardi*

[27]*Pseudorhabdosynochus* sp(p). of groupers are suggested to represent *Pseudorhabdosynochus epinepheli*, *P. lantauensis*, *P. quadratus* and/or *P. serrani*, as recorded for serranids in the region by various authors; and Capsalidae indet. from Lutjanidae is suggested to represent *Benedenia lutjani*, known to infect the surface of a lutjanid fish species in the Great Barrier Reef (Rohde 2005, Whittington & Ernst 2002)

Nematoda:

[28]*Contracaecum*, *Porrocaecum* sp., *Hysterothylacium* sp., *H. aduncum* and *H. fortalaezae* were corrected to *Hysterothylacium* sp. in cases were species not occurring in Indonesia were misidentified as such, and to *H. carangis* (for carangid hosts), *H. scomberoidei* (for *Scomberoides* sp. as hosts, also

recorded within present study), *H. epinepheli* (for *Epinephelus* spp. hosts) and to *H. gibsoni* for *Saurida* sp. as host), regarding to the host specificity of these nematodes

[29]*Philometra* sp. from *Abalistes stellaris* is suggested to represent *P. balistii* (host specific); and *Philometra lateolabracis*, probably not occurring in the region (cf. Moravec et al. 2012), from Carangidae was sighted and corrected to *Philometra* sp., and to *Philometra nemipteri* from nemipterid hosts, and sighted and corrected to *P. sciaenae* for sciaenids, similar to *Philometra* sp. from sciaenids, compare remark[37]

[30]*Anisakis simplex* is not known from the region, and records of *Anisakis* sp. rather represent the local, predominant genotype *Anisakis typica* var. *indonesiensis* (80% of the worms), or one of the other five species genetically confirmed by Palm & Theisen et al. (2017) for the region (cf. Chapter 2)

[31]*Anisakis simplex* is not known from the region, and a photo in Baladin (2007) for the records from *Scomber* sp. (= *Rastrelliger* sp.) shows a camallanid nematode

[32]*Camallanus* sp. from *Priacanthus tayenus* was sighted and corrected to *Camallanus priacanthi* (because of its host specificity); *Camallanus* sp. from carangid *Megalaspis cordyla* was sighted and corrected to *C. carangis*; *Camallanus spinosus* (a *nomen dubium*) from the trichiurid *Lepturacanthus savala* is suggested to represent *Camallanus trichiuris* (as known from other trichiurids in the region); and *Cucullanus* sp. from *Lutjanus vitta* was sighted and corrected to *C. lutjani* (regarding to its host specificity)

[33]*Capillaria* sp. from carangid *Selar crumenophthalmus* was sighted and corrected to *Pseudocapillaria (Pseudocapillaria) carangi* (host specific)

[34]*Gnathostom*a sp. is not known from Indonesian marine fish, and is suggested to represent the morphologically and phylogenetically close *Echinocephalus* sp. (already recorded from various marine Indonesian fish, also by the author of the present thesis)

[35]*Mastigospirura cubicipitis* is herewith declared considered a *nomen dubium*, the figure in the reference Machida & Syahailatua (1994) - an original new species description from Indonesia - seems to rather show a camallanid nematode

[36]*Philometra* sp. from priacanthids is suggested to represent *P. priacanthi* (host specific)

[37]*Philometra* sp. (just as *P. lateolabracis*, compare remark[29]) from sciaenids is suggested to represent *P. sciaenae* (host specific)

[38]*Philometra* sp. from psettodids rather represents *P. psettoditis* (host specific), as recorded by other authors for these hosts in the region

[39]*Spirophilometra* sp. from fins of trichiurids is suggested to represent *Philometroides trichiuri* (host and site specific), as recorded by other authors for these hosts and site in the region

[40]*Philometroides* sp. from fins of serranids rather represent *Spirophilometra endangae* (host and site specific), as recorded by other authors for these hosts and site in the region

[41]*Procamallanus* sp. from platycephalids is suggested to represent *Procamallanus* cf. *(Spirocamallanus) platycephali*, as recorded for this host in the region by the author

[42]*Raphidascaris* sp. from nemipterids is suggested to represent *Raphidascaris* cf. (*Ichthyascaris*) *nemipteri*, as recorded for these hosts within the present study

[43]*Raphidascaris* sp. from trichiurids is suggested to represent *Raphidascaris* (*Ichthyascaris*) *trichiuri* (host specific)

Acanthocephala:

[44]*Acanthocephalus lucii* was recorded from marine environments, but is suggested to be a misidentification for Indonesian fish host *Abalistes stellaris*, and is therefore corrected to Echinorhynchidae indet.

[45]*Anisakis* spp. from *Abalistes stellaris* are Acanthocephala according to figures (cf. Zarry et al. 2017), and are suggested to represent Rhadinorhynchidae indet., or probably *Rhadinorhynchus laterospinosus*, as recorded for the host in adjacent Vietnam by Amin et al. (2011b)

[46]*Echinorhynchus gadi* (as synonym *E. socialis*) is restricted to cooler waters in the Northern hemisphere, thus a misidentification, and therefore corrected to *Echinorhynchus* sp.

[47]Acanthocephala indet. from *Selar crumenophthalmus* was sighted and further identified to *Gorgorhynchus medius* (according to host and zoogeography, compare Parukhin (1976) and Amin & Ha (2011))

[48]*Rhadinorhynchus* sp. from *Thunnus* spp. is suggested to represent *R. zhukovi* or *R. johnstoni*, according to host specificity and zoogeography; these species are known for bonitos in the region

Crustacea, Copepoda:

[49]*Caligus* sp. from scombrids is suggested to represent *C. infestans*, *C. regalis* and/or *C. asymmetricus*, as they have been reported from these hosts in the region

[50]Lernanthropid *Lernanthropus* sp. from *Rastrelliger brachysoma* is suggested to represent *L. kanagurta*, as reported from the host in the region (type host is, however, the carangid *Megalaspis cordyla*); and *Caligus* sp. from this host (*M. cordyla*) was sighted and corrected to *C. cordyla*, as recorded for this host in the region by Theisen (2009) and within the present study; and lernaeopodid *Brachiella* sp. from *Lutjanus vitta* was sighted and corrected to *Parabrachiella lutiani*, as recorded for the host in the region within the present study

[51]*Caligus* sp. from *Thunnus albacares* is suggested to represent *Caligus productus*, as recorded from the host in the region

[52]*Caligus* spp. from Serranidae are suggested to represent *C.* cf. *acanthopagri* and/or *C. epinepheli*, as recorded for these hosts in the region

[53]*Hatschekia* sp. from *Epinephelus* spp. was sighted and identified as *Hatschekia fuscoguttatus*

[54]*Nothobomolochus* sp. from *Trichiurus lepturus* is suggested to represent *Nothobomolochus trichiuri* (host specific)

[55]*Acanthochondria* sp. from *Psettodes erumei* is suggested to represent *Chondracanthus psetti* (host specific) (*A. psetti* is a synonym); and *Anurets* sp. from *Platax teira* is suggested to represent *A. teiraxi* (host specific)

Crustacea, Isopoda:

[56]*Aegathoa* is a `form´ genus, the species of which are immature Cymothoidae (see Chapter 1.3.3.6)

[57]*Gnathia maxillaries* from *Plectropomus leopardus* might rather represent Gnathiidae indet., because fish parasitic praniza larvae are unidentifiable morphologically unless they are raised to adult males

[58]*Barybrotes indus* was collected without host, but is a parasite of Chondrichthyes; further isopods collected without host await comparison with other region's hosts of respective taxa

[59]*Cymothoa* cf. *truncata* recorded for *Trichiurus lepturus* by the author of this present thesis (Theisen 2009) was sighted and re-sampled now, and represents *Lobothorax typus*

Further remark:

[60]*Rhynchoscolex* sp. (Catenulida: Stenostomidae), *Apiosoma* sp. (Ciliophora: Sessilida: Epistylididae) and *Balantidium* sp. (Ciliophora: Vestibuliferida: Balantidiidae) were recorded for the grouper *Epinephelus sexfasciatus*, awaiting confirmation

12. Appendix I.3: Reference List of Appendix I.1: Literature on Indonesian Parasites of Marine, Free-Living Fishes (Actinopterygii)

Anggraeni Y 2014: Identifikasi Dan Prevalensi Cacing Pada Saluran Pencernaan Ikan Kakap Merah (*Lutjanus sanguineus*) Di Pelabuhan Perikanan Nusantara Brondong Lamongan Jawa Timur. Thesis, Fakultas Perikanan dan Kelautan, Universitas Airlangga, Indonesia: 56pp. (In Indonesian)

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Arifudin S, Abdulgani N 2009: Prevalensi dan Derajat Infeksi *Anisakis* sp. pada Saluran Pencernaan Ikan Kerapu Lumpur (*Epinephelus sexfasciatus*) di TPI Brondong Lamongan. Jurnal Sains dan Seni ITS E: 34-37. (In Indonesian)

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Baladin LO 2007: Study on Survival of Anisakidae Larvae in Frozen and Salted Indian mackerels (*Rastrelliger* spp.). Thesis, Sains Veteriner dan Sekolah Pascasarjana, Bogor Agricultural University, Indonesia: 65pp. (In Indonesian)

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